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WHEN THE BABY LEARNED TO WALK

She was adopted, at the most interesting age, by a girls' camp, and she taught the girls more about Mothercraft in a few weeks than they would have learned in as many years of the ordinary domestic science curriculum. Her first efforts at locomotion particularly excited wonder. Photograph by Mrs. Luther H. Gulick. (Frontispiece.)

BABIES IN THE CURRICULUM

Education Given Girls in Separate Colleges Dwarfs Instead of Developing Their Emotional Nature—An Example of Natural Education That Was Successful

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OUR Women's Colleges are on the defensive. The wide press publicity given to the JOURNAL OF HEREDITY articles[1] on the low marriage and birth rates of graduates from women's colleges drew broadsides from many quarters. College deans, professors, alumnae and students fired inky eloquence at the eugenicists' thesis, but nowhere do they seem to have hit the real issue a telling shot. Miss "Alumna, A.B.," speaking a whole page of *The Ladies' Home Journal*[2] at several million readers, for instance, says that college does not unfit a woman for motherhood, nor does it drown the desire for wifehood and motherhood, nor in any way make a girl fundamentally less a true woman. She says the reason she never married is because she was never asked, and the principal reason she was never asked is because young men thought themselves economically unable to support her and preferred marrying a girl outside their own social set to waiting until their salaries could foot the supposedly necessary bills. She quotes her own brother as saying:

> "We brand our love with a dollar sign. We're all slaves of *front*. That's the reason young men in our set don't marry young girls in our set. They think they can't support them. They think the girls think the same thing. So they pick out a girl to whom $25 a week looks as big as $50 looks to you."

She regretfully cites the fact that working girls in her own community are marrying the men in her own college set, attributing this to economic considerations only, and saying, of these men:

> "Nearly all the men calling on me were making small salaries, with larger salaries ahead, far ahead. I wondered if they held the same views that Tom held. As for my views, none of them ever gave me a chance to state them!"

Now in that last sentence lies the crux of the whole matter. In our co-ed colleges, like the University of Wisconsin, for example, young men and women have a fairly wide range of opportunity for finding out each other's views. They get used to talking about things that do not ordinarily crop up in drawing room conversations in the post-college social world. They discuss present affairs, and what they will do with themselves afterward. They live on a fairly democratic plane where economic differences are largely levelled. Courses in biology, sociology, psychology and political economy break the ice for individual and collective talkings about marriage, divorce, parenthood and even eugenics as though they were living issues instead of esoteric mysteries or uni-sexual affairs.

In our exclusive women's colleges girls grow up in a traditional atmosphere of femininity heavily tinctured with a fossil "culture" that is only beginning to be modified by the present-day and practical. That nature has built a goodly number of women in such a manner that they survive living for four years in this medium and bring their womanliness through unscathed

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[1] Johnson, Roswell H., "Marriage Selection," JOURNAL OF HEREDITY, V, pp. 102–110, March, 1914. Johnson, Roswell H. and Stutzmann, Bertha J., "Wellesley's Birth Rate," JOURNAL OF HEREDITY, VI, pp. 250–253, June, 1915. Sprague, Robert J., "Education and Race Suicide," JOURNAL OF HEREDITY, VI, pp. 158–162, April, 1915.

[2] June, 1916.

is providential but not to the point. What happens is that a host of them, and probably this is true of those unmarried ones of whom the Johnson and Sprague statistics speak, fail to carry away with their diplomas that obvious, though subtle and intangible something that makes a young man say to himself:

> "There is a girl I can chum with. I can talk with her freely about almost anything without an irritating feeling that I ought to be discussing woman's rights, or that she suspects me of ulterior and far-sighted plans against her self-sufficient solitude."

The Johnson and Sprague figures talk of that unconscious encrustation of intellectual primness, that palpable and reserving something that is almost bound to appear on the surface of a girl who has spent four of her very best years in nunnish isolation from young men of her own caliber, and from the world-old influences that stir and keep alive the root affections of womankind. This carapacing may be only partial, or it may be almost complete, and it is undoubtedly far below the girl's own consciousness as one's more characteristic mannerisms are apt to be, **but the fact remains that in many cases at least it is enough to account for that "not being asked" that is attributed to to economic and other causes.**

It may be that the very fact of having been through college casts a fine net of difference about a woman, holding some young men aloof. It may be that a college course connotes some degree of wealth and, by implication, ideals of material living higher than most young men can immediately obtain. It may be that choosing a career is taken to imply that a young woman prefers that course to marriage. It is probably true that all these causes, together with the fact that some of our young women suffer at least an outward dessication of essentially feminine qualities, help roll up the damaging statistics. The story they tell, however, remains the same. The marriage rate of graduates from women's colleges is strikingly below par.[3]

WHERE ARE THE BABIES?

And as for the drive at the spirit of the curriculum, a glance at even those of our colleges for "domestic science" will amply prove the contention that they are pretentiously superficial and dustily intellectual. There are rows of little gas stoves over which prospective wives conduct culinary chemical experiments. There are courses in biology, something of physiology and hygiene, the art of interior decoration and the science of washing clothes. There is text-book sociology and sometimes lectures on heredity or eugenics. But the smile of incredulity as to my seriousness when I asked the principal of the Margaret Morrison Carnegie School of Domestic Science, "Where are the babies?" is typical. Babies were impossible. They would interfere with the curriculum, there was no time for practice with babies, and besides, where could they be got, and how could they be taken care of? The students were altogether too busy with calories, balanced rations, and the history of medieval art.

But when I asked where the babies were, I did not have in mind the necessity for learning how to feed an infant or how to strap it in a perambulator. I was thinking of what a baby could mean in the life of a young woman who looked forward to home-making, of the rôle it would play in the education of her true self, not merely of her memory for facts.

It was astounding to think that there was actually no place in America where

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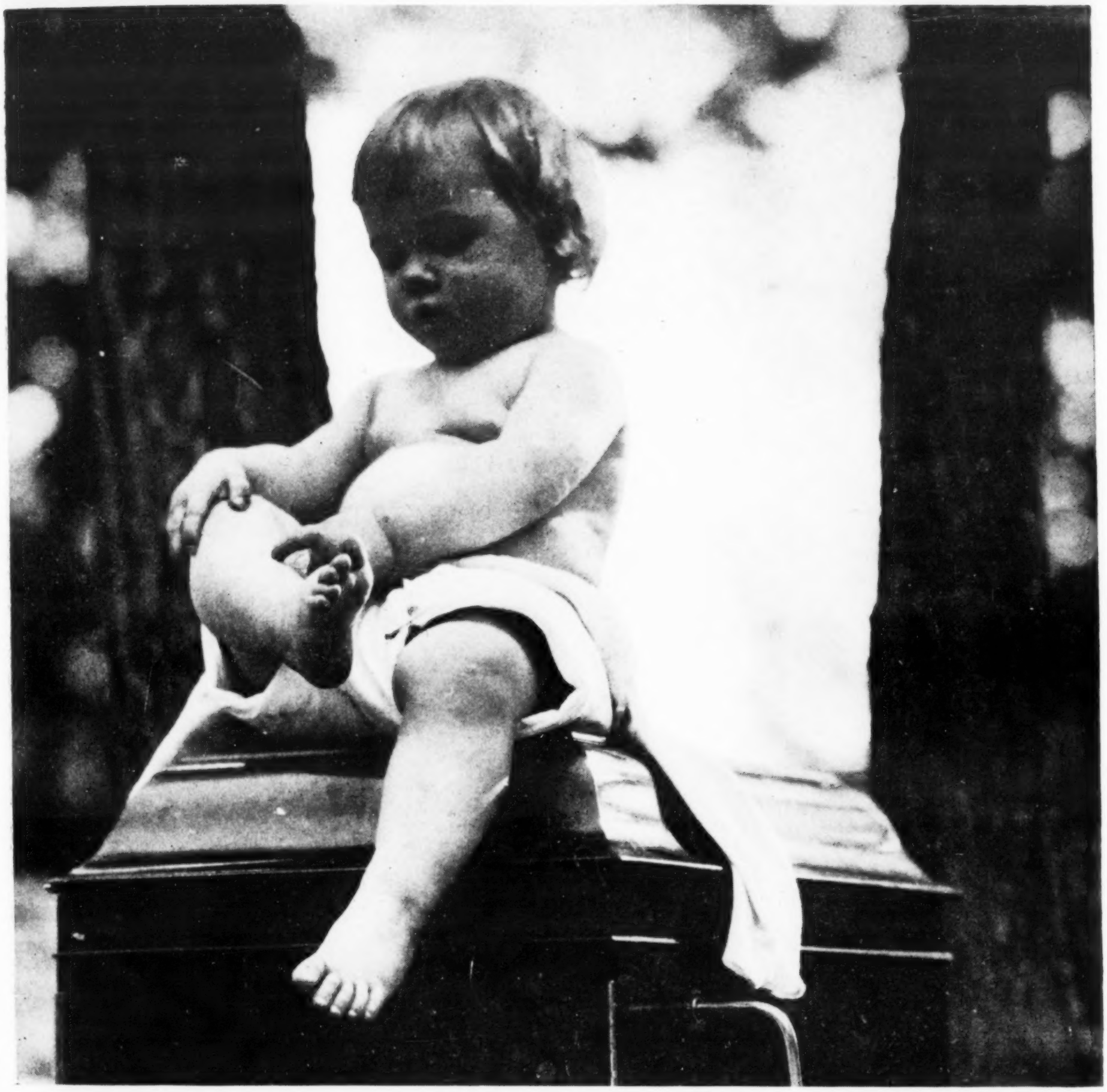
[3] Briefly, less than half of the graduates of the principal women's colleges marry, and they bear not more than two children apiece—a number so small as to ensure a rapid disappearance of their section of the race. The record of honor graduates, who may be presumed to represent a particularly select lot of families, is even worse than that of the graduates as a whole. The non-collegiate sisters, cousins and friends of these graduates have a better record, although they come from the same social class and are subject to the same influences, except for the college course. This indicates that it is actually the college course which keeps girls from marriage and from making an adequate contribution to the next generation. The record of the girls in the coeducational colleges is also better.



HER FINGERS WERE TAUGHT NOT TO SCRATCH

They learned to stroke softly and gently instead. It was one of the first and most important lessons given her; and it was equally important for the young girls who looked on. Photograph by Mrs. Luther H. Gulick. (Fig. 1.)

a young woman could go who wanted really to learn mothercraft, the craft of the heart as well as of the head.[4] To be sure Mary Read had been working in New York for five years trying to make the weight of her small school felt, a school where babies played a big part in the scheme of things and where, although the letter was a bit schooly, the spirit was lively and fresh. The Little Mothers' League had been quietly at work getting girls and babies together in a sometimes very happy fashion, and the program of Camp Fire Girls included a goodly round of baby-craft and home-craft honors. But at Morrison Carnegie, at Simmons, at Bryn Mawr, at a score more higher schools for women, there were only text-books and gas ranges and lectures and examinations.

I was privileged, however, to witness

[4] In New England there is a school for this purpose which is, in many ways, excellent. But the students are never allowed to see a baby; they handle only a big doll! A live baby is impossible, we are informed, because its presence in the class would make the girls giggle. It would be interesting to know how many graduates of women's colleges have failed to find mates because their instructors had eradicated from them the ability to giggle, together with all the freshness and spontaneity of the feelings which giggling denotes.

SOMETIMES SHE PADDLED IN THE LAKE

But her nights were apt to be a bit restless after such experiences—another lesson in Mother-craft for thirty young girls. Photograph by Mrs. Luther H. Gulick. (Fig. 2.)

an incident during an eight weeks' visit to a summer camp for girls that raised my hopes concerning the future of education for American young womanhood. I will sketch, briefly, some of the things that I saw. Most of them centered in Janet.

Janet scratched. She would double up her little fist into a taloned claw and, quick as a flash, it would shoot straight out for one's nose or cheek and scratch with all its might. An impish, hard, unlovely look came over her sweet baby face when she did this thing and Hiiteni, the Camp Mother, wondered how the habit could be stopped, for in every other way Janet was the gentlest and happiest of infants. So Hiiteni watched for the first symptoms of that cat-like stroke, and when the fingers began to double into claws, she seized the little hand and drew it over to her face, placing it against the cheek gently, drawing it downward softly and saying: "Nice, nice, nice." In two or three days the old habit had been replaced by the new. Janet would look up rougishly, reach out toward nose or cheek again, but touch gently, softly with a downward love-stroke. Later she learned to say

THE LITTLE IRON TUB WAS SAFER

It was warm on the rocks, in the sun, and she enjoyed it almost as much as the lake. Photograph by Mrs. Luther H. Gulick. (Fig. 3.)

"ice, ice, ice" as she stroked a face with her hand and smiled the happiest of baby smiles.

MOTHERING JANET

And all this time the girls watched—thirty of them, young girls from well-to-do homes who had come to camp for the summer. They were there for a good time. Their days went to paddling in canoes, swimming and diving in the lake, hiking on the country roads, sleeping out under the stars in the woods, tenting on the huge grey rocks, sewing, weaving, wood-blocking, decorating diaries and paddles, canning fruit, making dishes and mugs of clay, and—mothering Janet.

Two by two the girls cared for the baby every day. In pairs they watched her wake in the morning, bathed and weighed her. They brought her to the long table where she learned to hold a mug and drink from it, learned that some plates are hot and some are cold, and that girls at camp are very tuneful and very noisy. Two by two they washed Janet's clothes, hung them to dry and brought them in. Two by two they watched Janet at play and took her off to dreamland.

Hiiteni, the Camp Mother, watched her girls mother Janet, guided, controlled, suggested each day, but never preached and never let those thirty young girls feel that they were in school, learning most important lessons. The girls learned what was good for the baby to eat, and to wear and to feel (for when she was allowed to paddle for ever so little a while in the lake, her night was restless, and so she was treated to the

warmer waters of her small iron tub). One of them wrote a "tub song" for the morning bath:

Splash, splash on Janet's toes,
Tweek-tweek, Janet's toes,
Janet's eyes, blue, blue,
Janet has two pink ears, too!
Baby's mouth, round—so!
Pearly teeth, all in a row.

They watched the baby's every move, saw her grow day by day, saw the plotted curve of the weight chart go up, slide down, rise again, but always reach a higher point at the end of a week than the place where the week had begun. In their journals they recorded some of the things they saw, and they built a Baby Book of Janet's doings. Sometimes in prose, sometimes in verse, they set the doings down.

Janet loves to creep along,
Beside a little bug,
And pinch it with her fingers,
Or squash it on the rug.

I've seen her take a flower
And press it to her nose,
And, in attempt to smell it,
Janet merely blows!

Have you seen Miss Janet,
Watch the sunshine chase
The shadows in the morning
From their hiding place?

The girls read their observations at the weekly council fires on Monday night. Sometimes they merrily pantomimed the care of Janet, and the lessons in baby craft that they had learned. They called the baby "Moon-Child" and invented special honors, to be won by all who did things for Janet in a systematic way. For each girl wanted to mother the baby, and organization by turns was necessary for the youngster's welfare. Therefore the two by twos.

Janet was the hub of that camp. The curriculum, if the happy freedom to keep busy as one chose could be called such, was moulded elastically to fit its principal part. Were the hymns at morning service interrupted now and then by a gale of laughter at one of Janet's pranks? Well, then, surely God would be just as pleased as he may have been with the singing, for surely song and laughter go hand in hand in praise of the Creator's handiwork. Did Janet sometimes struggle to her moccasined feet, totter across to the reader of a morning Bible verse or poem, take the book in her hands and insist on turning the leaves? Well, then, was it not Jesus himself who had set down the little child in the midst of the people and declared that "Of such is the kingdom of heaven?" The regular order of things, program, curriculum—what had they to do with the case? They were to serve, not to dictate, to help when they might, not to inhibit wherever they could.

Before the girls went home, the baby's first words came. They were watched for earnestly and the tantalizing sounds that form the first faint dawn of speech were duly recorded. The first real laugh rippled out in the midst of a serious councilors' meeting, liquid, clear, prolonged, unmistakable. After that it was often practiced, but the thrill of hearing it for the first time was memorably sweet.

But the day of departure came, and each girl would have taken Janet home if she could. One of the older girls, whose parents were visiting camp, begged that she might have Janet as part of her Domestic Science course at Bryn Mawr. For Janet had only been adopted by the Camp Mother for the summer and was about to be returned to the steaming city where her mother tried to make ends meet on $5 a week. But the idea was too novel, too unprecedented.

Another girl was more fortunate and persuaded her home folk to let her adopt another infant temporarily, that she might continue her fascinating fun of mothering at home.

Two girls of the group, eager for the adventure of college in the fall, approached the authorities of Bryn Mawr on the subject of having a college baby. Janet had proved "practicable" at camp so why not mothercraft through the winter, too? What the college powers replied is too trite to need repeating. Needless to say, the girls went through the regular mill with only a bright memory to keep the innermost self alive.

IT WAS AN HONOR TO WASH JANET'S CLOTHES

Some of the work connected with practical Mothercraft is not, under ordinary circumstances, the pleasantest in the world; but the camp girls entered into it in the spirit of fun and friendly rivalry, and found it all interesting. Photograph by Mrs. Luther H. Gulick. (Fig. 4.)

And this is my principal point: That these girls were getting real education, the education of the affections, the training of the emotions, the directing of desire. Intellectual culture was an insignificant side play, and, although the momentousness of that tender, delicately plastic learning instrument, that small, restless mass of exquisitely sensible impressionableness grew upon them, and although the significance of the early learning process together with its evident detail was clear before them as a bit of practical psychology—that was not the capital issue at all. The mystery and wonder of childhood played incarnate before them. The marvel of it had time to sink deep into their own impressionable souls. They came to love it, and to find joy in serving it, even to the washing of its sometimes very dirty clothes. There was contagion in the child's character. They absorbed the atmosphere that its presence created. They had opportunity and leisure to learn real things.

For the very word school comes from the old Greek word *schole* (σχολή) which meant *leisure*. And education means to *draw out*, *lead forth* (educare). These girls had leisure to observe, to experiment, to do things of their own accord, to ask spontaneous questions, and to sit on the great grey rocks beetling over the lake and *think*.

Eight weeks of such education—for let it not be forgotten that along with mothering Janet went swimming, dancing, canoeing, tramps on the open road and through the deep forest, handcraft, letter-writing, pantomime and play, music and stories around the open fire, reading together from good books and communion one with another around a self-cooked meal—eight weeks of

such education, as Doctor Luther Gulick has so often pointed out—is worth intrinsically more in any girl's life than a year at college grinding over books and cramming for examinations.

But need we abandon college for this? Why should we? Let the little leaven leaven the whole lump. Let our women's colleges, if they insist on nunny, feminine isolation, at least afford a part time outlet to the deeper springs that lie in the nature of every normal girl. Let us have college babies—there are thousands waiting for adoption, or a temporary adoption during early infant-hood. Let us have professors who will bring their babies into the class room as well as their books. Let us have teachers who have come up to high standards of motherhood, as well as high standards of classic learning, to draw out the mind and spirit stuff of young American womanhood. Let the women's college campus be sprinkled with baby carriages, and those of the co-ed college, too. And not for "child study," or the psychology of babies. Not for the learning process, not that coming mothers may know how to modify milk or pin a diaper; but that the finer feelings, the big and powerful affections shall be kept alive and wholesomely exercised, that the spontaneous exuberance of childhood be kept, that we remember what we are in the world for, individuals to serve the race. That is the large lesson in preparedness for the duties and privileges and joy of tomorrow. This is the spirit of the real eugenics, or foresight and devotion for the children that are to be. This is the Gospel of baby Janet, lived out in the evergreen woods.

A Champion of Darwinism

SOCIAL PROGRESS AND THE DARWINIAN THEORY, a study of Force as a Factor in Human Relations. George Nasmyth, Ph.D. With an Introduction by Norman Angell. Pp. 417, $1.50 net. New York, G. P. Putnam's Sons, 1916.

That Dr. Nasmyth should have thought it worth while to write this book is striking evidence of the prestige which Darwin, after half a century, retains. The work is in effect a piece of propaganda for world federation, which the author declares is the logical outgrowth of the Darwinian and true view of social evolution. Because those who preach the "philosophy of force" attempt to justify themselves by citing Darwin and alleging the necessity and desirability of a struggle for survival among nations, Dr. Nasmyth (following the Russian Novikov) has undertaken to show that they wholly misunderstand the Darwinian doctrines. It is not difficult for him to demonstrate this, and his chapter on "The Biological Errors" of the philosophy of force deserves wide circulation, for many biologists are prone to forget that the primary struggle for existence is against the environment of the species, and not against other members of the same species. Unfortunately, Dr. Nasmyth gives the impression that he thinks Darwin said the last word on the evolution of man, and that nothing is necessary now but rightly to apprehend his views and act on them. The sciences of eugenics and social psychology, however, have made great strides since Darwin wrote "The Descent of Man," and much of what Nasmyth seems to consider fundamental truth is now discarded dogma. Probably primitive Darwinism is less harmful to society than the perversions which Nasmyth is attacking, and which wholly ignore the factor of mutual aid in evolution. Nevertheless the interests of science—which are identical with the interests of social progress—would be better guarded if the world-federation propagandists could take their stand on the biology of today, rather than on that which Darwin knew. Beyond this, the book is marked, like most sociological works, by lack of rigid definitions and by unlimited citations of other peoples' opinions, instead of direct appeals to facts; but read with critical care, there is much in it that should prove stimulating and valuable to thoughtful people.

THE LONG-LIVED FIRST-BORN

Study of 802 Cases of Longevity Shows that Eldest Sons and Daughters are Unexpectedly Numerous—Possible Biological Explanations—Elder Children Regularly Live Longer than Younger Children

THE EDITOR

IN THE controversy over the alleged inferiority of the first-born, no direct investigation has been made, so far as I am aware, of the number of long-lived people in the community who are eldest sons or daughters. The Genealogical Record Office of Washington, D. C., has been collecting instances of longevity for several years and its founder and director, Dr. Alexander Graham Bell, has generously permitted me to investigate the data in regard to the birth-rank of the old people represented in his collection.

The individuals were, in general, over 90 years of age, some living and some dead. A few were included whose age was less than 90 but more than 80; these, however, represent a very small proportion of the total. Information about them was supplied in nearly every case by a near relative; in the case of living individuals it was often from the long-lived person himself. There were 802 cases in which the individual's birth-rank was stated[1] in some such form as, for example, "third of a family of eight;" and there seems no reason to doubt that the information given under this head is accurate.

A tabulation of the size of families from which these long-lived individuals came showed the following results:

1 child	16
2 children	21
3 children	60
4 children	75
5 children	88
6 children	92
7 children	81
8 children	98
9 children	90
10 children	79
11 children	44
12 children	30
13 or more	28

It is at once evident that long-lived people tend to come from large families—a fact that has already been pointed out in this JOURNAL.[2] It must be remembered, however, that the families here tabulated date back to the early part of the last century, when large families were the rule in the United States. All of the individuals represented in this study are living or died in the United States; many of them, however, were born abroad and came here as immigrants.

With the size of each family and the individual's place in that family given, it was easy to count up the number of individuals in each birth-rank, and then to calculate how many there would have been, if the distribution had been governed solely by chance, with as many long-lived people in one birth-rank as another. The results, taking only the families of two or more children, and omitting decimals in the second column are:

	Found	*Expected*
1st	201	132
2d	118	132
3d	104	121
4th	95	101
5th	82	82
6th	40	65
7th	53	50
8th	30	38
9th	22	26
10th	20	16
11th	4	9
12th	8	5
13th	4	3
14th	2	1
15th	3	

[1] This information was extracted by Miss Louise E. Lacey, secretary of the G. R. O., and I did not refer to the original returns. Thanks are due to A. W. Clime for help in tabulating.

[2] "Long Life Means Many Children," in the JOURNAL OF HEREDITY, Vol. VII, pp. 98–100, March, 1916.

The first thing to strike the attention is that the first-born, who have sometimes been supposed to be handicapped with all sorts of physical weakness from birth, are relatively more numerous than any other birth-rank. But the number of individuals in the last birth-ranks is somewhat surprising, in view of the generally accepted belief that the last child of a very large family tends, because of uterine exhaustion in the mother, to be defective, and is often an imbecile of the so-called Mongolian type. The table here given shows at least that the last-born of a large family is not necessarily lacking in a tough constitution which will enable him to survive for ninety years or more.

As the number of children in the ranks beyond ten is too small to give reliable comparison, I have added these together to make one rank of eleven and more children. To facilitate comparison, I have reduced the figures to a percentage basis, taking as the base-line in each birth-rank 100.[3] We then get the following fair comparison of the proportion of long-lived people which the various birth-ranks have furnished:

1st	152
2d	90
3d	86
4th	94
5th	100
6th	61
7th	106
8th	79
9th	85
10th	125
11th and up	117

The preponderance of first-born is still striking, but the high proportions in the last birth-ranks are somewhat unexpected. I think the latter situation can be partly explained on statistical, rather than biological grounds. If a centenarian were the youngest of thirteen brothers and sisters, for instance, his descendants might well be struck by the fact and remember it; therefore they would put it down in furnishing data to the Genealogical Record Office. If, however, their ancestor were in the middle of such a family, there is slightly less likelihood that they would remember his exact birth-rank and therefore they would, in a greater number of cases, leave that blank unfilled when furnishing information. This is merely a conjecture, but seems to me sufficient to account for the presence of some of these late arrivals—whose absolute numbers, it must always be remembered, are very few.

Will a similar supposition account for the presence of any of the first-born in the table? I think it very possible that relatives might more easily remember that Uncle Abner was the eldest son, than that he was fifth-born, in a family of nine. It may be, therefore, that we have in our statistics a greater number of first-born than an absolutely random sample of the population would furnish. But this appears to be a source of comparatively small, if any, error, because the preponderance of the first-born is as striking in families of two and three as it is in some of the larger fraternities. Admitting that this may have contributed slightly to swell the number of first-born, I do not think it can reduce seriously the great preponderance—217 out of a total of 802, if we include the sixteen who were an "only child." This preponderance can be well shown in another way, by the percentage table on page 397, which Dr. Alexander Graham Bell prepared.

The evidence appears to me conclusive that, among the long-lived people in the United States, eldest sons and eldest daughters are considerably more frequent than would be the case, if longevity had no connection with birth-rank.

How can we square these results with those reported[4] by Karl Pearson: that still-births are most frequent among

[3] The number found was multiplied by 100 and the product divided by the number expected. This device was used by Corrado Gini (JOURNAL OF HEREDITY, Vol. VI, pp. 35–39, Jan., 1915) in showing that first-born were most frequent among the college professors of Italy.

[4] Pearson, Karl. On the Handicapping of the First Born. London, 1914. Summarized in the JOURNAL OF HEREDITY, Vol. VI, pp. 332–336, July, 1915. Pearson's conclusions are not wholly confirmed by other data. A. Ploetz, for example, found in 3,319 births in the German nobility, that there was very little difference in the percentage of deaths under 5 years, when taken

Order of birth	Total No. of children	No. lived to be aged	Per cent lived to be aged
First born children	802	217	27.05
Second born children	786	118	15.01
Third born children	765	104	13.59
Fourth born children	705	95	13.47
Fifth born children	630	82	13.01
Sixth born children	542	40	7.38
Seventh born children	450	53	11.77
Eighth born children	369	30	8.13
Ninth born children	271	22	8.11
Tenth born children	181	20	11.04
Eleventh, twelfth, thirteenth, fourteenth and fifteenth born children	188	21	11.17
Total	5,689	802	14.09

the first-born, that infant mortality is higher among the first-born, that the health of the first-born child, during its early years, is below par?

INFLUENCE OF NATURAL SELECTION

Natural selection appears to offer a satisfactory explanation. At the birth of the first child, the maternal mechanism is less well adapted to its work than is the case at subsequent births. Particularly in the case of middle-aged women, physicians say that the strain to which the child is subjected at birth is greater at the first than at subsequent parturitions. The first-born child is, therefore, *more stringently selected* than are his brothers and sisters; a greater percentage of the first children die at birth. Now if we make the assumption that those who die are, on the average, inherently weaker than those who survive the ordeal, it follows that the average of strength, among the first-born adults in a population, would be higher than among the second or later born; not because they were as a rank superior physically from the start, but simply because a greater proportion of the weaklings were eliminated at the start.

If, then, we draw a sample of long-lived people from the population, we would expect to find more first-born among them because the initial incidence of natural selection left the surviving first-born more fit, on the average, than the surviving second, third, or fourth-born.

This hypothesis may well be supplemented by the fact which biometricians[5] have found, that the elder children are *more variable* in respect to longevity, than are the later-born. Increased variability naturally gives all the more scope for the action of natural selection; and while those who vary in the direction of physical inferiority will be eliminated at birth, the survivors will represent children who vary in physical superiority to a greater extent than do their younger brothers and sisters. This variation will naturally result in the production of a considerable number of long-lived individuals.

If the facts have been correctly interpreted, then the prevalence of first-born in a collection of long-lived individuals has a real biological foundation, and is not a mere statistical fallacy. This conclusion is supported by the fact,

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by birth-rank. See JOURNAL OF HEREDITY, Vol. V, p. 268. Researches cited by H. H. Hibbs, Jr., (Infant Mortality, p. 56, N. Y., 1916) show that in many cases the infant mortality is lowest when the mother is under 20 and when the birth in question may fairly be supposed to be her first, in a large proportion of cases. These data may not be so weighty as the larger series quoted by Pearson, but should at least be taken into account.

[5] Beeton, Mary and Pearson, Karl. Inheritance of the Duration of Life. Biometrika, Vol. I, pp. 50–99, London, 1901.

found long ago by biometricians,[6] that elder children tend to live longer than younger ones. The investigation in question did not deal directly with the first-born, but is obviously parallel to a certain extent.

Dealing with a thousand or more pairs, Miss Beeton and Pearson then found the following average ages at death:

	All adult	*Elder adult*	*Younger adult*
Sister.....	57.795	59.924	55.667
Brother.....	56.568	58.560	54.575

Here an elder brother or sister was one who might have been born one year or twenty before the younger brother or sister. For both sexes, it seems that the elder lived about four years longer than the younger.

The result appeared so interesting to them that they secured 1,051 pairs of brothers and 733 pairs of sisters where the interval between births was known, and further studied them. "The data," says Prof. Pearson, "are not quite the same as for our pairs of adult brothers and sisters given above, but they show much the same advantage, *i.e.*, four years to the elder. They further demonstrate that longevity is correlated with position in the family.[7] This fact is suggestive for the source of other variations in the characters of an array of brethren. It may be that variability within the array is not purely random, but correlated like variability in longevity, with birth order. Our numbers show that on the whole the earlier-born members of a family are the stronger, or at any rate fitted to survive the longer."

It was possible from the data to work out interesting formulae for predicting the probable excess of life (e) of an elder brother or sister from a knowledge of the birth interval (i), both being taken in years:

Elder brother $e = .7282\, i - .2795$
Elder sister $e = .8525\, i - 2.5951$

"Thus a brother born ten years before another brother has probably seven years greater duration of life; a sister born ten years before another sister has probably about six years greater duration of life." It is hardly necessary to add that these formulae will rarely hold good in individual cases, but apply only when a large population is dealt with.

While these Beeton-Pearson data may appear to conflict in some ways with the Genealogical Record Office data which I have compiled, it must be pointed out that they are not directly comparable. The former were taken from pedigrees kept by the Society of Friends in England, while the latter are isolated cases picked out of a very heterogeneous population, on the basis of a single fact—that an individual had reached advanced age.

In conclusion, it has been shown that among the long-lived people in the United States, first-born are proportionately more numerous than any other children. It is suggested that this may be because they are (a) more variable in respect to longevity and (b) subjected to a more stringent selection at birth. Previous work showing that earlier-born children in a family live longer than later-born appears, as far as it goes, to corroborate the validity of the conclusion reached from a study of the Genealogical Record Office data.

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[6] Beeton and Pearson, *ubi supra*.
[7] The facts as given by Beeton and Pearson, p. 54, are:

	Brothers	Sisters
Mean excess in life of elder.....	4.289 yrs.	4.542 yrs.
σ of excess.....	22.0053 yrs.	22.1325 yrs.
Mean interval between births.....	6.462 yrs.	6.7503 yrs.
σ of interval.....	4.3530 yrs.	4.6856 yrs.
r.....	.1062 ± .0206	.1201 ± .0246

USUAL GROWTH HABIT OF WHITE-BARKED PINE

A typical specimen in appearance, but larger than usual. The tree stands on what was doubtless once a grave or the site of a small temple; remains of the grave or buildings have long since been obliterated by farmers. This beautiful pine has been introduced to the United States, but appears to lose its white color if it is grown in a moist locality. Photograph by D. F. Higgins. (Fig. 5.)

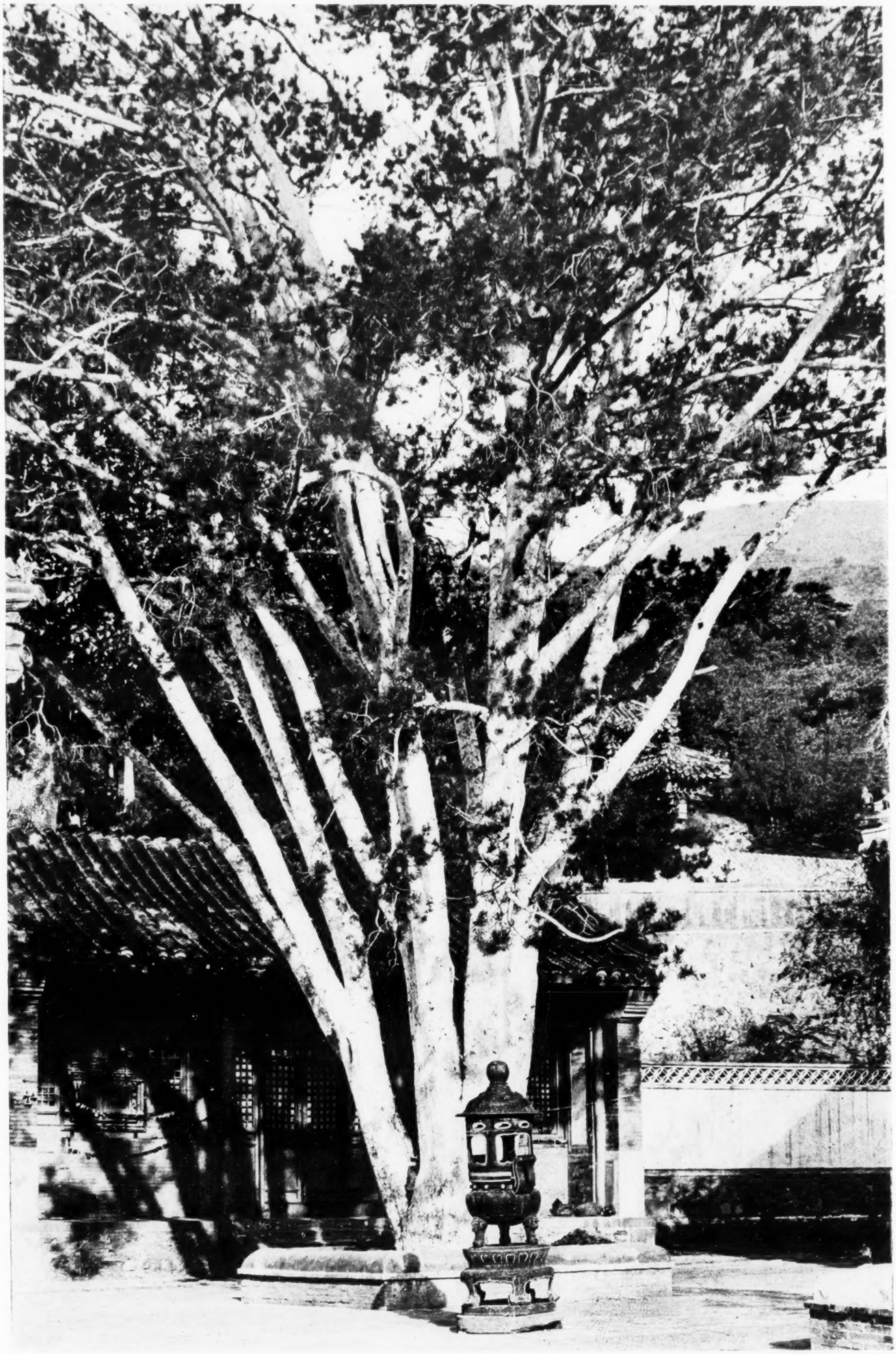
THE WHITE-BARKED PINE

D. F. Higgins, *Peking, China*

IN ONE of my first trips sight-seeing around the city of Peking, when almost anything new and strange was taken quite as a matter of course, I remember seeing in the enclosure of "Coal Hill" some pine trees whose snow-white bark shone out from their green foliage. I wondered at the time why it was that the Chinese whitewashed their pine trees. Later, however, in excursions into the country, I found that my whitewashed pines were not whitewashed, but that they had a white bark.

I became interested in this curious tree, and later, largely through the inspiring acquaintance formed with Frank N. Meyer, Agricultural Explorer of the United States Department of Agriculture, I took a number of photographs which may be of interest to the readers of the Journal of Heredity.

The tree (*Pinus Bungeana*) is most striking and noble in appearance, and



THE PINE IS OFTEN PLANTED NEAR A TEMPLE

This specimen stands in the ground of Tan Chao Ssu, a famous temple in the mountains west of Peking. With the brilliant white bark and clear green foliage among the yellow and green tile roofs, all against the dark green of juniper and oak-clad hills, it is a sight not soon to be forgotten. This is the finest specimen seen among several hundreds in the vicinity of Peking. Photograph by D. F. Higgins. (Fig. 6.)

would form an attractive addition to any park or estate. There is a feeling of awe and mystery inspired by the flashes of brilliant white through a shadowed grove such as might arise if elves were lighting fox-fire by day. The fact that the trees are planted principally about grave sites does not tend to lessen this feeling.

Besides being used for ornamental purposes around graves, they are also to be found in many of the temple grounds which abound on the plain around Peking and nestle in the mountains west of the city. I have seen no trees not planted by man, but I have heard that this tree grows wild in the low mountains west of Paotingfu, some distance southwest of Peking. The species seems to be one nearly extinct, and which thrives only in narrow climatic limits. Its introduction into the United States would be worth while attempting, however.[1] Mr. Meyer has superintended the securing of one of these trees which has been placed over the grave of W. W. Rockhill, late United States minister to China.

The Chinese name of the white-barked pine is "pai kuo sung," pronounced locally about Peking, "pai-kuor-sung," "the white fruit-pine." This name is due to its white bark, and to the use of the seeds as a delicacy and in confections.

On the Proportion of "Born Criminals"

Discussing "Defect in germ-plasm as a cause of delinquency" in an editorial in the July issue of the *Journal of Delinquency*, Thomas H. Haines, director of the Ohio Bureau of Juvenile Research, concludes that 25% is about the limit of feeblemindedness that can be found in any unselected delinquent population—for example, the inmates of a penitentiary or reform school. Feebleminded is here used to mean that "they are so poorly endowed with intelligence that they are unable to manage themselves and their affairs with prudence." Better tests are needed, Dr. Haines says, to get at the mentality of the rest of the delinquents. "That there is mental abnormality of some sort underlying the moral perversion, in a large percentage of not insane and not feebleminded delinquents, we are free to grant. . . . But there is much abnormal mentality that is not due to defect in germ-plasm." This, Dr. Haines thinks, is the result of bad education, and can be corrected in many cases by proper treatment. For the hereditarily defective mind, little can be done.

The Inheritance of Feeblemindedness

In the May and July issues of the *Journal of Delinquency*, Arthur S. Otis, of Stanford University compares the conflicting views on the manner in which feeblemindedness is inherited. There can be no doubt but that heredity is to a large extent accountable for different degrees in brightness; the question is whether or not these different degrees of brightness can be said to be inherited as Mendelian unit characters. After reviewing the conflicting views, Otis concludes that no good case has yet been made out by the Mendelists, and that while Mendelian heredity of degrees of intelligence is easily conceivable, it cannot be proved until we have more knowledge of the development of the mind, and better means of measuring our quantities.

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[1] The office of Foreign Seed and Plant Introduction, United States Department of Agriculture, has sent out seedlings of this pine (Inventory No. 41954) secured by Mr. Meyer, and these are now growing at various places in the United States. A large specimen introduced earlier by Dr. C. S. Sargent is growing in the Arnold Arboretum, Boston. It does not show the white-barked character, and it is quite possible that this will only appear on specimens grown in a dry climate. The Office of Foreign Seed and Plant Introduction will be glad to correspond with anyone who wishes to grow this pine in the United States.—THE EDITOR.

POLLINATION IN THE PINE

PLANTS which depend on the wind for fertilization must necessarily have pollen adapted to travel by air. If a plant regularly depends on bees or other insects to carry its pollen, the pollen-grains are likely to be sticky and fairly large. If, however, the pollen must be transported by the wind, then the grains must necessarily be as light as possible and sometimes, as in the pine, they are furnished with wings or air sacs to buoy them up.

So equipped, pollen grains can travel almost incredible distances. Engelmann, a careful and trustworthy observer, reports:[1]

"The property of the pine pollen to float for a long time in the air, and to be carried by storms to very distant localities, is well known. I have found in streets of St. Louis after a rainstorm from the south, in March when no pines north of Louisiana were in bloom, pine pollen which must have come from the forests of *Pinus australis* on Red River, a distance of about 6½° of latitude or 400 miles in a direct line."

The male and female flowers of the pine are quite distinct, as will be seen from Fig. 8, but are borne on the same tree. The male cones appear in the eastern United States late in the fall, lie dormant through the winter and ripen their pollen in the spring, the pollen being ready for dispersal in May or June. In March or April the female cones can be distinguished; they develop rapidly until they are mature at the same time as the male cones.

At about the time that the staminate flowers are launching their clouds of glistening pollen on the wind, the axis of the female cone elongates, thus forcing open the scales, which heretofore have been pressed together and have presented an impenetrable exterior. At the base of each scale are two ovules, not enclosed in

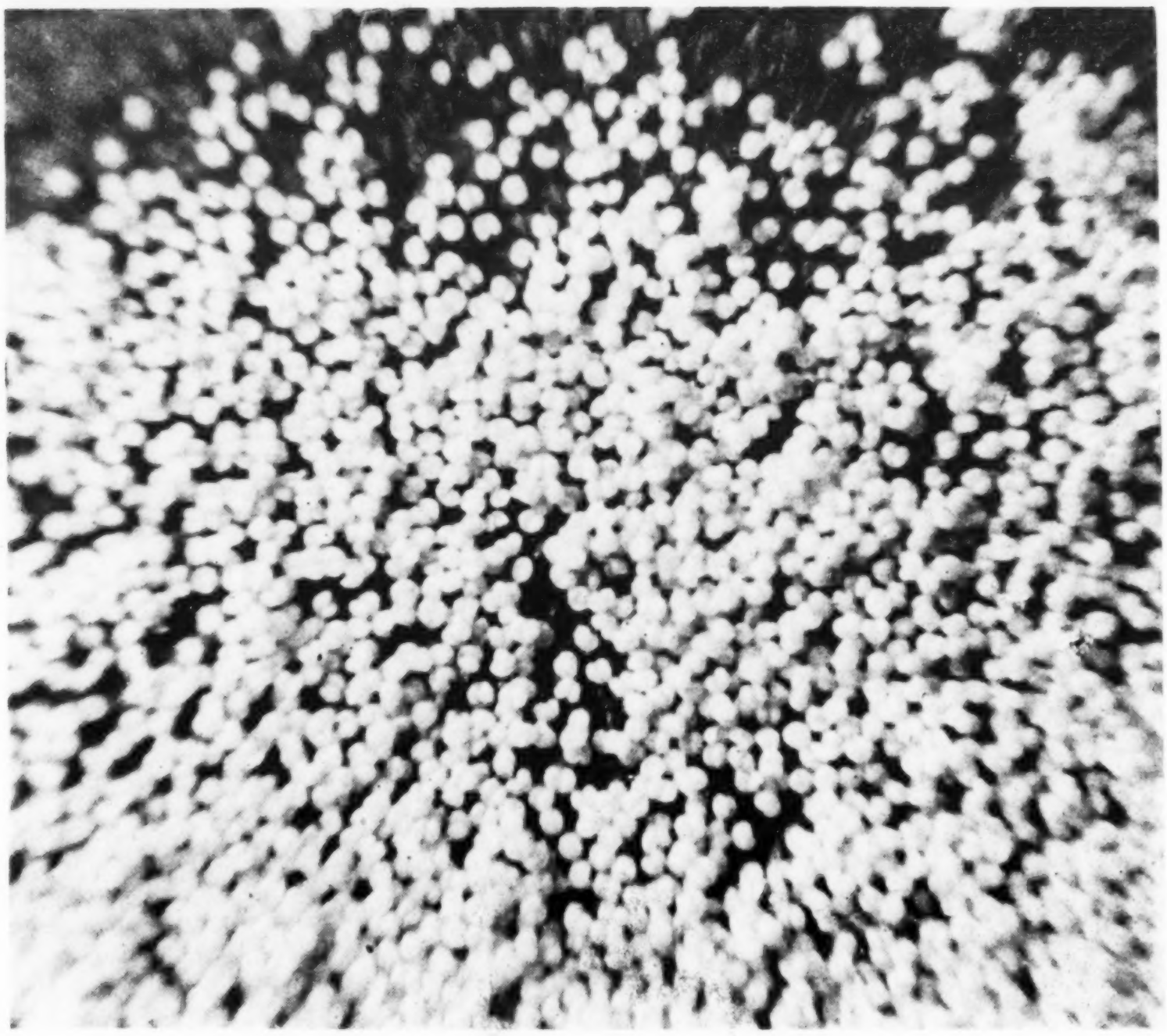
FECUNDATION OF THE OVULE

The ovule or egg-cell of the pine (*P. austriacus*) is here photographed, immensely enlarged, about one year after it was pollinated. The pollen grain has lain dormant within it for that length of time, but is now beginning the actual fertilization. In the center of the egg can be seen the large maternal nucleus at the top of which the functional male nucleus has made a deep depression—a feature characteristic of the pines. Very shortly it will enter the egg-nucleus at this point and the two nuclei will unite, bringing together the hereditary material which each carries and thus starting the development of a new tree. At the upper end of the ovule a large vacuole is seen as a clear spot, to the left of which is the second male nucleus, which takes no part in fecundation. Photo-micrograph from David M. Mottier, Bloomington, Ind. (Fig. 7.)

[1] In Trans. St. Louis Academy, Vol. IV, p. 159.

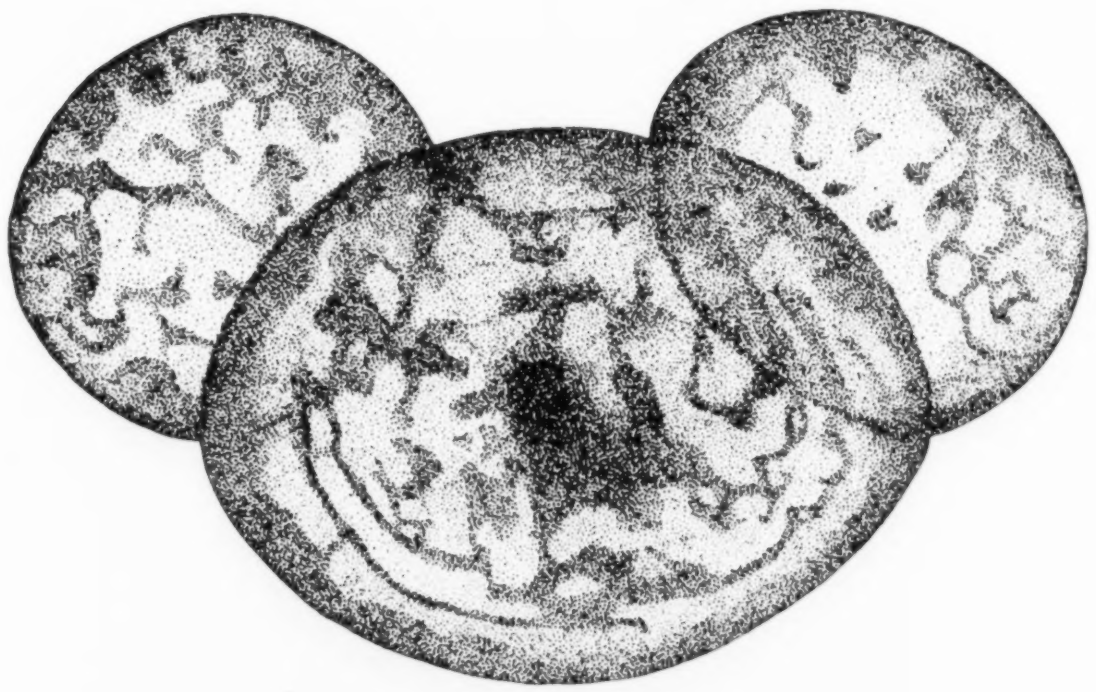
FLOWERS OF THE PINE

At the base of the spike is a cluster of male cones, which have already opened and begun to shed their pollen. Grains of the pollen can be seen sticking to most of the pine-needles in the photograph. Above is a single female cone branching from the slender twig. The pollen of the pine is carried by the wind, insects playing no part in the pollination of this tree. Photograph, much enlarged, by David Fairchild. (Fig. 8.)



GRAINS OF PINE POLLEN

They show little tendency to stick together, whereas the pollen of plants that depend on insect visitors is often exceedingly sticky, so that it will adhere to the legs and bodies of insects. The pollen of the pine is much smaller than that of most plants; it is here shown as seen by reflected light. Photo-micrograph by David Fairchild. (Fig. 9.)



THREE-CELLED POLLEN GRAIN

The pollen of pines is adapted to travel with the wind by the possession of wing-cells or balloons. The grain consists of three cells, one of which is fully developed and contains the nucleus, while two at the sides are hollow and contain nothing but air. They buoy up the nuclear cell and enable it to travel almost incredible distances—as far as 400 miles in extreme cases. Drawn by W. H. Lamb, of the U. S. Forest Service. (Fig. 10.)

an ovary as is the case with most flowering plants, but lying quite exposed, as with all the gymnosperms or "naked-seed" plants. Pollen drifts into the openings between the scales and slips down to the base, where some of the grains fall on the ovules. There is an opening to each ovule, and the opening is surrounded by a collar of cells which form a tube to receive the pollen. When the pollen grain is once inside this tube leading to the ovule, the opening closes up so that it cannot get out. Shortly afterwards, the scales of the cone are said to close up once more, thus protecting the ovule during the course of its further development.[2]

With many flowers, fertilization—that is, the union of the sperm-cell and egg-cell—takes place almost immediately after pollen has reached the ovule. But in the pine there is an extraordinary delay, often covering a period of thirteen months. The pollen-grain does indeed begin to germinate immediately after it has entered the ovule. But when it has gone through a few divisions, and put forth a pollen tube, it rests for a year. Not until late in the following spring, in most species, does it actually reach the egg-cell.

When fertilization does take place, it is more thorough than in many species. Not only do the nuclei of the two cells unite, but the cytoplasm of the two cells fuses, whereas in many cases the cytoplasm—that is, all the material surrounding the nucleus—of the male cell is rejected.

To obtain a good photograph of the process of fertilization is a very rare thing, but Prof. David Mottier, of Indiana University has sent the remarkable one reproduced in Fig. 7. Here the two nuclei can be seen, just about to unite. Most, if not all, of the heredity of the species seems to be carried in the nucleus of the cell; consequently it is the union of cell-nuclei that constitutes the essential fact in zygosis or fertilization. By this act the inherited characters of the male and female parent are brought together, to lie side by side in the individual which results from the growth of the fertilized cell, and to be shuffled up, recombined and segregated in its posterity.

Breeding Sugar Cane

Four generations of seedling cane are being grown at the Porto Rico experiment station, Rio Piedras, P. R., and several new varieties of value have already been developed. It has been found almost impossible successfully to pollinate cane by hand, because of the smallness of the cane flower, the height at which the inflorescence is produced, and its brittleness. Success has been had, however, by planting two varieties in parallel rows, a pollen-sterile variety on the leeward side of one pollen-fertile. The wind does the rest.

State Survey in Illinois

The Illinois Committee for Mental Hygiene is contemplating a state-wide survey of the amount and ramifications of mental defect. The work would be centralized in Chicago. This action is in line with that taken recently by a number of communities, and must eventually be followed by the whole nation, as the realization becomes more widespread that a large part of the crime and misery is due to inherited mental defect, and that most of it can be wiped out, within a generation, without excessive labor or expense.

[2] For a careful technical account see Ferguson, Margaret C. Contributions to the Knowledge of the Life History of Pinus, etc. Washington, 1904.

A CHANGE IN SEX-RATIO

Overwhelming Preponderance of Male Births Among Certain Tribes of Costa Rican Indians—Females in Great Majority Among Adults—Tribes Rapidly Disappearing

HENRY PITTIER
Bureau of Plant Industry, Washington, D. C.

IN 1903, I published in the *Berlin Zeitschrift für Ethnologie* a short note on the Tirub, or on what is left of that once powerful tribe, dominating the plains and mountains bordering on the present boundary line of Costa Rica and Panama. The abode of these remnants is now restricted to the upper reaches of the Tararia or Changuinola River, included in the territory of the latter republic.

In the above mentioned contribution, there were given some statistical data showing the rapid decrease of the Tirub and the unusual numerical disproportion of the sexes, the great majority of children being males.[1]

I visited these natives in 1898 and the statistical information reproduced about five years later from my diary was given as a résumé of the complete census made during my expedition, the originals of which had been mislaid.

Not very long ago, these detailed sheets of my census were found. They cover not only the whole Tirub tribe, but also the larger part of the Bribrí of the Costa Rican Talamanca. In view of the numerous researches and publications referring to sex determination and control, these data appear so interesting that I now undertake to prepare them for publication. I do this also in justice to the readers of my former article and because such information may throw some light on the process of disintegration of a race.

The above cited paper dealt with a portion only of the Tirub, and showed a proportion of thirty-six females to 100 boys among the children. It further stated that since the first known census, in 1700, when the tribe numbered about 2,300, there has been among them a steady and rapid decrease in the natality until in 1898, there were left fifty-seven individuals, among whom were fourteen boys and five girls under marriageable age. The real figures at that time as shown below should have been given as eighty-nine individuals with thirty-one boys and eleven girls, and a slight predominance of the males among the adults. Among the children, however, the given sex ratio remains the same with the new totals.

It was shown further that the same process of rapid extinction, indicated not only by a lesser natality but also by a great exaggeration of the sex ratio, existed in another Costa Rican tribe, the Guatusos, living at the headwaters of the Rio Frío. In 1896, Bishop Thiel found it to consist of only 203 individuals, seventy of whom were females, the ratio being fifty-two of these to each 100 males.

In the same expedition during which the Tirub information was gathered, I made also, as stated above, an extensive survey of the inhabitants of the valleys and mountains of Uren in the Costa Rican Talamanca. These people belong to the Bribrí tribe, another part of which inhabits the district of Ararí, which I did not visit at the time. There

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[1] Similar disproportionate sex-ratios are said to have been found among the Indians of Guatemala and Nicaragua, and parts of South America, but in no case has the state of affairs been described by such an accurate census as Mr. Pittier was able to make. E. Westermarck cites the travelers' accounts in his "History of Human Marriage," Chapter XXI. Among other primitive peoples, it would appear that the proportion of girls born is sometimes equally excessive. In civilized countries there appears an extraordinarily steady ratio of something like 105 boys to 100 girls born.—The Editor.

is also a small settlement of the same Indians in the Cabagra Valley, on the southern watershed of the cordillera.

The results of both the Tirub and Bribrí censuses are now given in full, as follows:

I. Census of the Tirub Tribe.

Name of locality.	Adults.		Children.		Totals.		Grand totals.
	Males.	Females.	Males.	Females.	Males.	Females.	
Brusik 1st house	1	1	3	0	4	1	5
Brusik 2d house	1	1	2	0	3	1	4
Brusik 3d house	1	3	2	0	3	3	6
Urustán	2	4	5	0	7	4	11
Iabólu	1	3	3	0	4	3	7
Surtsik	5	5	5	0	10	5	15
Ararbó	3	5	3	3	6	8	14
Peksó	1	2	3	2	4	4	8
Uniâ	1	4	2	3	3	7	10
Temisik (Śongsó)	2	1	3	3	5	4	9
Houses 10	18	29	31	11	49	40	89

II. Census of Part of the Bribrí Tribe.

(a) Bribrí Mountains, Talamanca.

Name of locality.	Adults.		Children.		Totals.		Grand totals.
	Males.	Females.	Males.	Females.	Males.	Females.	
Stutuk	5	5	6	3	11	8	19
Sinitz	2	2	2	0	4	2	6
Ukábęta	2	2	0	2	2	4	6
Dutsábęta	3	3	3	2	6	5	11
Akutz	4	3	4	3	8	6	14
Bęríbęta	3	7	1	1	4	8	12
Dępuk	3	4	2	2	5	6	11
Durúnu	2	2	2	1	4	3	7
Bóbri	2	5	2	3	4	8	12
Tsukuñak	3	6	3	1	6	7	13
Skarúbkitsa	2	4	0	9	2	13	15
Dutz	2	3	1	2	3	5	8
Suríski	4	3	0	0	4	3	7
Bętsúokir	4	4	0	1	4	5	9
Butz	3	2	3	0	6	2	8
Dutsábęte (2)	5	3	2	1	8	4	12
Dutsásura	2	7	2	2	4	9	13
Urítska	1	3	2	1	3	4	7
Tuki	4	6	3	1	7	7	14
Bísbęta	3	4	2	1	5	5	10
Tsuríkur	3	4	3	2	6	6	12
Korímbęta	2	3	0	0	2	3	5
Torókkitsa	2	3	0	1	2	4	6
Puríbęta	2	4	2	3	4	7	11
Torókdipe	2	4	2	3	4	7	11
Nęmu-ú	2	3	0	3	2	6	8
Mokri	7	5	2	1	9	6	15

Name of locality.	Adults.		Children.		Totals.		Grand totals.
	Males.	Females.	Males.	Females.	Males.	Females.	
Burúbẹta	3	3	1	0	4	3	7
Amókitsa 1st house	2	6	1	0	3	6	9
Amókitsa 2d house	3	1	2	0	5	1	6
Tsambri	3	3	1	0	4	3	7
Tsukátz	2	3	3	0	5	3	8
Surébeta	3	5	0	3	3	8	11
Dẹkó-ú	4	5	1	0	5	5	10
Surúk	5	5	1	1	6	6	15
Xkurdzuk	2	3	0	0	2	3	2
Kúko	1	3	0	1	1	4	5
Sẹuís	3	3	2	0	5	3	8
Buráburábẹta	2	4	5	0	7	4	11
Trútuk	2	2	0	1	2	3	5
Urúkbẹta	4	6	1	3	5	9	14
Kátsibẹta	3	2	2	3	5	5	10
Nẹuós	4	2	2	1	6	3	9
Surítuk	2	3	1	1	3	4	7
Karkádzẹua	1	1	2	1	3	2	5
Bikatz	2	2	0	3	2	5	7
	130	166	74	58	204	224	428

(b) Inner plain of Talamanca.

Tsâki	1	1	3	1	4	2	6
Tsimukurki	1	1	4	1	5	2	7
Konó-uoripe	5	6	2	3	7	9	16
Sauskurki	1	1	0	0	1	1	2
Sausbẹta	0	1	2	0	2	1	3
Bẹkitsa	1	2	2	3	3	5	8
Datsí-kurki	1	1	1	0	2	1	3
Sklúkote	3	3	3	1	6	4	10
Dicóte 1st house	1	3	5	1	6	4	10
Decóte 2d house	2	4	0	0	2	4	6
Dicóte 3d house	1	1	2	1	3	2	5
Dicóte 4th house	0	2	2	1	2	3	5
Dicóte 5th house	1	2	3	0	4	2	6
Dicóte 6th house	2	1	0	1	2	2	4
Tea	5	6	5	4	10	10	20
Bẹkurki	2	2	1	2	3	4	7
Kitákitsa	1	1	0	0	1	1	2
Kokbliñak	2	3	5	3	7	6	13
Skarúbkitsa	2	3	2	0	4	3	7
Dutsákurki	2	4	2	0	4	4	8
Tsanáki	3	5	3	3	6	8	14
Bẹkátsuo	3	3	1	0	4	3	7
Korbliñak	1	1	2	0	3	1	4
Hacienda	2	2	1	0	3	2	5
Tsuríkurbri 1st house	3	4	1	1	4	5	9
Tsuríkurbri 2d house	1	0	1	0	2	0	2
Murusíkdio	2	2	3	1	5	3	8
Ogdi	6	7	2	2	8	9	17
Tsrarkorñak	4	4	3	3	7	7	14
	59	76	61	32	120	108	228
Mountain Bribrí	130	166	74	58	204	224	428
Plain Bribrí	59	76	61	32	120	108	228
Grand totals	189	242	135	90	324	332	656

Males and females to each 1,000 *of population.*

		Males.	*Females.*
Tirub	Adults	202	326
	Children	348	124
	General	550	450
Bribrí	Adults	288	369
	Children	206	137
	General	494	506

Tribe or part of tribe.	Females to each 100 males.		Males to each 100 females.	
	Adults.	Children.	Adults.	Children.
Tirub	161	36	62	262
Bribrí (Mountain)	128	78	78	128
Bribrí (Plain)	129	52	78	191
Bribrí (General)	128	67	78	150

The known history of the Tirub shows that during the seventeenth century, they constituted a powerful nation, which extended its sway over all the neighboring tribes. They made frequent raids on these, plundering, killing the men, carrying away women and children. The fact that at that time and as long as they were able to maintain their supremacy, they were essentially exogamous, and also polygamous, should perhaps not be overlooked when studying the probable causes of their decadence. The existence at one time of both conditions is proved not only by repeated documentary mention of the abduction of females of all ages, but also by tradition and actual occurrence. The Térraba Indians still speak of a time when each man was allowed several wives, and also of the punishment inflicted by the friars when the monogamic rule imposed by them was infringed. On the other hand, during my residence in Térraba, one of the former Tirub colonies in the Diquís Valley, I became acquainted with several natives who had taken their wives from among the Bribrí and Cabécara of the northern slope. Asked about the reason why they had gone so far to find their matrimonial mates, one of these men tried to explain that such wives were more "recatadas," *i.e.*, modest or shy, than those of his own surroundings, but others referred to the fact that such was the practice among their forebears and that this was encouraged by the missionaries.

Notwithstanding all the evidences of the practice of exogamy before the advent of the Spaniards, I must not omit to mention that there are also vague indications of the tribe having been at one time organized in two clans between which marriages took place exclusively, as will be explained in connection with the Bribrí.

The decadence of the Tirub started with their subjection by the Spaniards at the beginning of the eighteenth century. The persuasion of the missionaries and the fear of a bloody repression put an end to the inroads on their neighbors and to the practice of exogamy. A considerable part of the tribe was led away to the several colonies founded by the friars in other parts of the country and no small number were driven to the Spanish settlements to become the slaves of their conquerors. Worse still, smallpox, pulmonary and catarrhal infections, almost always fatal among them, and other imported diseases took a heavy toll among the once strong and warlike nation.

Heretofore, they had roamed freely over mountains and vales, spending the dry season fishing and hunting in the extensive plains along the coast and retiring with the accumulated provisions for the rainy winters in the sheltered fastnesses of their hinterland. In the plains were also their extensive plantations, built up for each family by the common work of the community with the accompaniment of eating and drinking revelries, as is still the custom

among the Talamanca Indians. Their crops consisted mainly of cassava and plantains, to which squashes and red peppers were probably added. Maize was hardly cultivated and beans were certainly unknown, since up to the present day they are found but seldom among the aborigines of the Atlantic coast of Costa Rica.

DRIVEN FROM THEIR HOMES

While this simple diet remained plentiful, the nation continued to thrive, until strangers began to invade the more accessible parts of their territory. Year after year these came in growing numbers, settling themselves in the fields of the hapless natives, who were thus robbed of their subsistence and frightened back into the narrow valley of the Tararia. The climax of the spoliation came about the time of my visit, when speculators grabbed what was left of the rich lands of the plains in prevision of future operations by a large banana concern.

These changes took place gradually, and gradually too, the living conditions of the natives became more impaired The narrow talweg of the valley, swept year after year by the torrential freshets of the larger streams, could not be tilled profitably, and the slopes are everywhere too steep for permanent cultivation. So the crops were forcibly reduced to a scanty minimum. The fish which abound in the lower course of the river, become scarce in the upper reaches and, at the time of my visit, the forest game had practically disappeared. All this necessarily resulted in a slow starvation of the Tirub, with the corresponding lowering of the vitality of the race. The resistance to diseases and other adverse conditions became less, the rate of mortality increased and with a diminished number of births came also the disturbance of the ratio of sexes as vividly shown in the above tables.

Among the Bribrí, the process of attrition has been about the same, though perhaps a little slower. These were among the people subjected to the dire oppression of the Tirub during the period preceding the arrival of the Spaniards. At that time also they were more or less obliged to seek the seclusion of their mountains, their enemies extending over most of the beautiful inner plain of Talamanca. Besides they paid tribute, according to tradition, to the Misquito Indians, who at that time dominated the coast from Gracias à Dios in the North to beyond the Chiriquí Lagoon, as is indicated still by numerous local names. A tradition gathered from the old men in Bribrí has it that each year, the flotilla of the warring Misquitos would appear at a certain time at Cahuita Point, and a slave runner was dispatched to the Bribrí bearing the insignia of command, a cane made of the cacique wood. This put the whole tribe on the way to the coast, every man and woman loaded with propitiatory presents. After the Spanish occupation, this dependency came to an end, though very much against the will of the Misquitos, who tried by every means to maintain it, and even penetrated once far into the Talamanca Valley with their dugouts after they had succeeded in crossing the dangerous bar at the mouth of the Tarire. On this occasion, however, they were not satisfied with provisions and cotton clothes, the usual tribute levied on the Bribrí, but a number of women and children were carried away into captivity.

After the last appearance of the Misquitos and the retreat of the Tirub into their own valley of the Tararia, the Bribrí enjoyed a relative quiet and attained some prosperity under the easy rule of the friars. Not that they submitted altogether meekly, for there were times of open revolt, when missionaries and colonists were pitilessly massacred and the churches and incipient towns destroyed. These outbursts were of course followed by bloody reprisals, but on the whole the tribe maintained itself in a relatively prosperous condition even to the last days of the past century.

MARRIAGE BETWEEN CLANS

With relation to marriage, their customs were very different from those of the Tirub. While polygamy was the

rule, the wives were taken from inside the tribe, according to a system which we might call semi-exogamic. The whole tribe was divided from the oldest times into two clans, each one of which was considered by the other as its "contrary." The men of one clan could marry only in the opposite clan, to which the children would also belong, the head of the family being not the husband, but the eldest brother of the mother. This custom was still rigidly enforced at the time of my exploration of Talamanca (1891–1898), when I succeeded in obtaining the complete list of the families forming each clan of the Bribrí.

Owing to this arrangement, the inner life of the tribe was not perhaps so deeply disturbed by the advent of Spaniards as was the case among the Tirub, and this is one of the explanations of the reason why the decadence of the Bribrí has proceeded more slowly, as shown by the above tables.

One of the first facts which draws the attention when studying these is the reversal of the ratio of sexes when we pass from the adult to the child generation. Among the former the number of females is far above the normal in all cases, while among the children the male element is overwhelmingly preponderant. It would seem, therefore, that the change has been a very sudden one, and this puts more difficulties in the way of a satisfactory explanation. That the adverse circumstances under which these natives live have been rapidly on the increase during the last years is an evident fact. The question is whether it would be sufficient argument to explain both the decrease in natality and the great disturbance of the sex ratio.

It has been suggested that certain native tribes limit the number of females by killing part of the baby girls at their birth. This, however, would not explain the present case and furthermore it certainly does not apply with regard to the Bribrí Indians, among whom I lived for nearly three years and into whose more intimate life I pried almost at will. Not being an admissible explanation for the Bribrí, this could not be used as to the Tirub, whose case is more or less identical.

On the other hand it is generally admitted that there is an automatic correlation between the birth rate and sex ratio on one side and the general vital conditions of the race on the other. The only apparent exception to that law is the presence of artificial conditions as produced by abuse of wealth and excessive physical refinement, as are known to exist in great cities and which lead so surely to race suicide. Under normal conditions, a strong, healthy stock tends to increase and with a higher rate of birth there is also a surplus in the number of females. Under adverse conditions, the facts become reversed. For instance, in a nation depleted of men and resources by war, natality is less and the proportion of males considerably larger. While statistical proof of these facts is inadequate, there is some evidence to support them, and they formed the base of the explanation given in my former paper.

Whatever this explanation, it is evident that factors have been in operation among these Indians that have resulted in a definite and pronounced alteration of the sex ratio.

Research Work at Sing Sing

At the annual meeting of the National Committee on Prisons it was announced that a fund of $20,000 a year for five years has been guaranteed to provide medical and scientific treatment for the prisoners at Sing Sing. The Committee on Eugenics has begun operations in cooperation with the Police Department of New York City to arrive at the constitutional or hereditary factors in anti-social behavior with the aid of carefully compiled family histories.—*Eugenical News* (Cold Spring Harbor, Long Island, July, 1916.)

HEREDITY OF HAIR-FORM

STRAIGHT hair is the primitive form found in the human race, but in some sections, particularly those inhabiting the tropics, a modification appeared very early in history, and resulted in the various forms known as curly, kinky (or frizzy) and wooly. The difference is in the form of the individual hair: straight hairs are round in cross-section, while

AMERICAN NEGRO x FILIPINO HALFBLOODS. (Fig. 11.)

the curved ones are seen, in cross-section, to be flattened, being sometimes only half as thick as broad.

Going farther back, we find that the difference in appearance is due to a difference in the shape of the follicles from which the hairs grow: straight hair develops in a plain, cylindrical follicle, while the follicle which produces the flattened types of hair is curved and inclined in relation to the skin. Apparently this change is one, the possibility of which is often present in human germ-plasm, for it breaks out occasionally when there is no hereditary history back of it, so far as can be discovered, for a number of generations.

It was noticed very early in the Mendelian study of heredity that these types were inherited distinctly and segregated. Davenport pointed out[1] that the curved condition seemed to behave as a dominant and the straight condition as a recessive, although his figures show that this does not hold strictly true, so that it is probable we are here dealing with a number of different heritable factors, instead of a single one—unless we suppose that it is a single factor which is subject to much variation.

The accompanying photographs from David B. Mackie, of Manila, show two sisters at Pangasinan, Philippine Islands. They are the offspring of a Philippine woman who had the straight hair characteristic of the Malays, and an American negro with wooly hair. This father, however, in Mr. Mackie's opinion, had some white blood, and therefore may be considered heterozygous for hair-form. Were this not the case, we should expect to find all his children with curling hair. The fact that one of the sisters has distinctly curling hair and the other distinctly straight hair is in itself fair evidence that the father was not a pure-blood negro. The photograph graphically illustrates the fact that hair-form is not a blending, but a segregating, character in heredity.

Effects of Alcohol on Germ-Plasm

That alcohol acts on the germ-plasm in such a way as to cause defects in offspring, has long been believed, but those who have investigated the evidence know that very little of it is valid. Dr. Raymond Pearl of the University of Maine is carrying on experiments with fowls to test the effect of alcohol, and finds no evidence that it has the effects attributed to it. A preliminary account of his experiments is given in the *Proc. Am. Philos. Soc.*, LV, pp. 243–259. He treated nineteen fowls with alcohol and raised 234 chicks from them. "Out of twelve different characters for which we have exact quantitative data, the offspring of treated parents, taken as a group, are superior to the offspring of untreated parents in eight characters" and inferior in two, while in the remaining two characters there is no distinguishable difference. The infant mortality, among chicks of treated parents, was decreased, the chicks were heavier than normal when hatched, and grew faster than the average. No deformities were found. Dr. Pearl thinks the effect of the treatment was to eliminate the weaker germs in the parents, so that only the stronger germs gave rise to offspring. He is continuing the experiment with larger numbers of birds to get data for several generations.

[1] Davenport, C. B., "Heredity in Relation to Eugenics," p. 34. New York, 1910.

CONSTITUTIONAL VIGOR IN THE ANCESTRY OF THOMAS A. EDISON

THOMAS A. EDISON'S extraordinary ability to support fatigue, and to work many hours at a time with little food or sleep, is well known, and the inventor frequently attributes this ability to his abstemiousness. George W. Barton, of Washington, has recalled this in a letter to Alexander Graham Bell, in which he quotes from an interview with Edison, by Dr. Richard Cole Newton, in the *Ladies Home Journal* several years ago, as follows:

"Years ago a book fell into the hands of the great-grandfather of the present Thomas A. Edison, the famous inventor. It was the story of an Italian nobleman, Lodovico Cornaro, who at the age of forty was told by his physicians that he had but a short time to live.

"Cornaro lived in an age—three hundred and fifty years ago—when eating and drinking cut a prominent figure in the lives of Italians, and this nobleman concluded that his broken health was due to over-indulgence. He resolved to change his mode of life and demonstrate a truth or two to the physicians.

"After some experiments in his diet he cut down his daily ration of solid food to twelve ounces, the equivalent of three-quarters of an ordinary five-cent loaf of bread. Next he determined to let fresh air into his house, and to live himself in the fresh air as much as possible and avoid all contention and worry. With these fundamental laws for healthful living he built up for himself an ideal mode of life. Health came back to him, and at the age of eighty-three he made known to the world, in print, what he had done and how he had thrived by his method.

CORNARO'S LONG LIFE

"His health had now become as good as it had been before he had injured it as a young man by improper living, and at the age of eighty-six he again reported on his vigor, his happiness and his freedom from all the ills of advanced age; at ninety-one he reported again and at ninety-five he added still further to his wonderful book that anyone may read today. He died at the age of ninety-eight, having lived fifty-eight years, in good health, beyond the date fixed for his demise by his physicians—and he outlived them all!

"So impressed was the great-grandfather of the present Edison with the sane and rational story of this fine old Italian nobleman that he took the teachings to himself and lived along the line of Cornaro's methods for years. He died at the age of one hundred and two years.

"The example of Mr. Edison's great-grandfather's long and healthy life was naturally not lost upon the son, and he—the present inventor's grandfather—followed the same teachings and died at the age of one hundred and three.

"The example of the grandfather of the present inventor was in turn impressed upon his sons, of whom there were seven. They all lived according to the teachings of Cornaro, and the example set before them by their father and grandfather, and all seven sons lived to be more than ninety years old!

"One of these sons was Samuel Edison, father of the inventor. He followed in his eating and in his daily life the example of his father and lived to the age of ninety-four years, passing away without apparent illness. He suffered no pain, life seeming to have come to its end in nature's way.

"This, then, was the marvelous record of abstemious living and consequent old age handed down by great-grandfather, grandfather, and father and six uncles to the present Thomas A. Edison. He determined that 'what was good enough for his ancestors was good enough for him,' and decided to

live the same life. This he has done with the result that the great inventor finds himself today, at the age of sixty-five, in sound health; with the wonderful record that he has been sick just four times in sixty-five years; he has had three or four headaches, and two or three winters ago he had a slight cold, the first in ten years. He has also had an attack of so-called middle-ear disease, from which he recovered in two or three weeks. This was in 1908, since which time he has been very well and hard at work.

"Naturally everyone will ask, what is this marvelous routine that has made possible this wonderful record? In the first place the routine is not marvelous at all; it is simply common sense, which, if followed by more of us, would obviate nearly all our illnesses and make it possible for us to reach the ages attained by Mr. Edison's ancestors, and to enjoy as good health as does the great inventor himself."

FALLACIOUS REASONING

Unfortunately for the interviewer's conclusion (which appears to be Edison's own) there is abundant evidence to prove that long life is due largely to heredity. The fact that an ascetic dietary is in this case *associated* with long life by no means proves that it *causes* long life.

"If Thomas A. Edison should live to be a nonagenarian or centenarian as he intimates he will through this methodical mode of a restricted diet, would it be a fair scientific deduction to attribute his longevity to the hereditary factor, or to his ascetic dietary?" Mr. Barton asks. To this Dr. Bell replied as follows:

"Both heredity and environment are undoubtedly factors in producing longevity. My researches indicate that the possibility of long life depends primarily upon the possession of a good constitution (which is an inheritable characteristic); and secondarily upon good habits of living (which are not inheritable).

"The case cited by you, of Edison's ancestors, is obviously one in which heredity is involved; for you have here a man living to 102 years of age, having a son who died at 103, and seven grandsons who all lived to be over 90.

"It is inconceivable to me that a system of diet could possibly be the cause of so extraordinary a result. It is more reasonable to suppose that a tendency to longevity existed in the family, and that the good habits of life permitted it to come into expression. In this connection it is interesting to know that a hereditary tendency to longevity appears in many families in spite of the prevalence of most unhygienic conditions.

"The case of the Italian nobleman, Lodovico Cornaro, who lived to be 98 after having been given up by his physicians at 40, is interesting but by no means conclusive, because nothing is said about his ancestors. It is true that he attributed his long life to his system of diet; but in most of the cases I have investigated where the excellent habits of life were supposed to be the cause of the longevity, I have found that the individuals came of long-lived stock."

Banns Law Proposed in Georgia

The desirability of a good banns law, as an aid to sexual selection, has been pointed out in this Journal. By preventing hasty and ill-considered marriages, it would probably tend to better matings from a eugenics point of view. The following news item from the daily press is of interest in this connection:

"Atlanta, Aug. 20.—A strict measure intended to curtail immorality and the divorce evil by preventing hasty marriages probably will be passed by the present session of the legislature.

"The bill provides five days must elapse from the time a marriage license is taken out before a ceremony can be performed; that there must be at least two competent witnesses; that the issue of a license must be published, and sworn statements must be made as to age and previous marriage."

PYRONIA

A Hybrid Between the Pear and Quince—Produces Abundance of Seedless Fruit of Some Value—Many New Combinations Might be Made Among the Relatives of the Pear

DR. L. TRABUT
Botanist of the Government of Algeria, Algiers

EARLY in 1913, Mr. Veitch, of London, sent me some cions of a hybrid he had recently obtained between Pyrus and Cydonia. He called this interesting creation Pyronia, and asked me to study it under the more favorable climatic conditions of our region. Since this new plant had proved to be an attractive ornamental shrub in the climate of London, I thought that in Algeria the fruits might be comestible, and Pyronia might become one of our cultivated orchard trees. The cions received were therefore grafted on well-grown stocks of a Moroccan pear recently described[1] (*Pyrus gharbiana* Trabut), which were growing in poor soil at the Botanic Station.

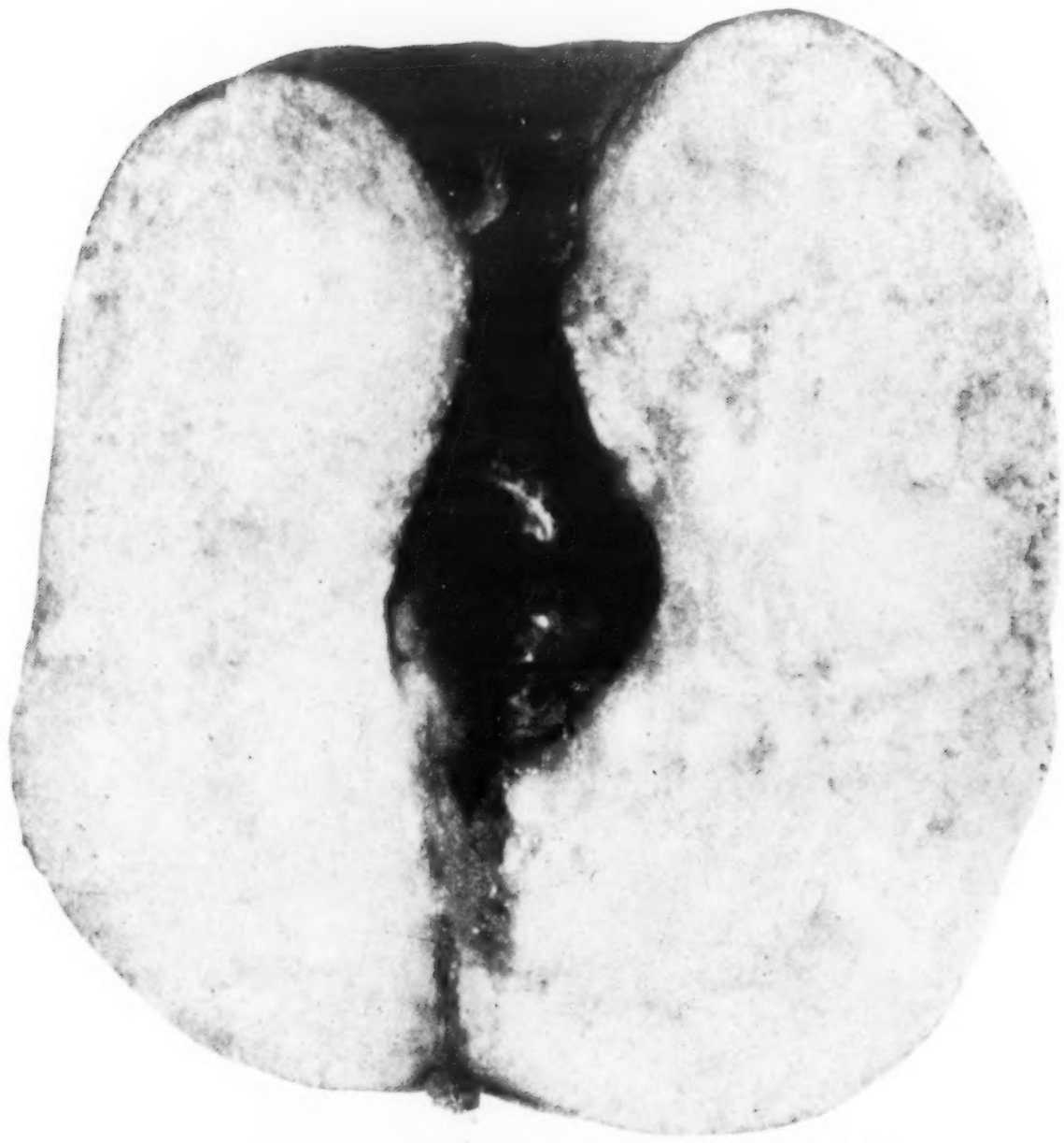
In November of the same year the cions had made a growth to 2 meters, and were as large as one's thumb at the base. In 1914 the first fruits appeared on variety A.

In the spring of 1915 they flowered abundantly and set a large quantity of fruit. The observations here described will deal only with the variety A, to which I have given the name X *Cydonia Veitchii* var. *John Seden*. It may be described as follows:

A vigorous tree resembling the quince, the wood brown with numerous lenticels. Leaves light green, the vernation very peculiar; one side of the leaf blade is inrolled, as in the pear, the other side, in place of being inrolled symmetrically, encircles the first so perfectly that the vernation may be called convolute. It is therefore intermediate between the conduplicate vernation of Cydonia and the involute vernation of Pyrus. Leaf-blades elliptic, entire, villous when young though very sparsely so on the principal veins and the petiole, the venation irregular; petioles one-third to one-fourth as long as the blades. Stipules inserted at the base of the petiole, villous, on vigorous shoots attaining a length equaling that of the petioles. The leaves adjacent to the flowers which appear in the first flowering period are larger than the normal ones, and less attenuate at both ends. The flowers are produced in clusters of three at the ends of the branchlets, each group arising from a cluster of large leaves arranged in a rosette. The pedicel bears two bracteoles near its base, one sometimes a third of the way up the pedicel. Calyx, with five deltoid lobes slightly incurved, pilose on both surfaces but more heavily so outside, the margins glandular-toothed. Corolla large, 5 cm. broad, aestivation quincuncial, the petals suborbicular, distinctly clawed, quite glabrous, white, tinged with rose, especially before anthesis. Stamens twenty, the filaments nearly erect in the ten alternating with the petals, curving in the others. Anthers violet, 3 mm. long, the pollen normal in appearance. Styles five, free, the ovary with five locules each containing two superposed series of three ovules.

The fruits are abundant, developing from nearly every flower, hence they are grouped in threes at the ends of the branchlets. A second period of flowering occurs after the first, solitary flowers, which also produce fruits, appearing at the ends of the branchlets of recent growth. In these flowers the corolla persists, and as the receptacles enlarge the petals take on a greenish tint. At the beginning of autumn there is a third period of flowering, but the fruits produced do not ripen.

[1] In Bull. de la Station de Recherches Forestières pour l'Afrique du Nord, Alger, 1916.



FRUIT OF QUINCE X PEAR HYBRID

The fruit is seedless, is almost intermediate between the two parents in character, and seems to promise some commercial value. It is proposed to call it Pyronia, a combination of the two generic names Pyrus (pear) and Cydonia (quince). This is a satisfactory trade name, but will not be accepted by the botanists who, it is suggested, may call it X *Cydonia Veitchii*. Photograph actual size. (Fig. 12.)

All of the fruits which I have been able to examine were seedless. During the early development of the fruit the two rows of ovules can be seen clearly in each locule, but later when the locules have increased considerably in length they are seen to be empty.

The form of the fruit is unusual and characteristic, cylindrical, slightly longer than broad, with a short peduncle arising from a shallow cavity, the eye situated in a deep basin, open, the calyx lobes persistent. The skin is thick, rough, green or yellowish-green, abundantly covered with red dots like that of a pear. The flesh is white, granular, firm, juicy, sweet, slightly acidulous with an agreeable quince-like perfume. The season of ripening is October and November.

It is not yet possible to state with confidence what place Pyronia will take in horticulture. The fruits which I have eaten were picked before they were fully ripe; the flesh was pleasantly flavored but firm as in a half-ripe pear. When cooked, the fruits seemed to be intermediate in character between a pear and a quince.

In 1915 an attempt was made to pollinate flowers of Pyronia with pollen from various pears, but no fruits were obtained. I did not attempt to pollinate with quince pollen, though that might offer a better chance of success. The validity of the genus Pyronia, proposed by Veitch, is open to discussion, because some botanists do not admit the validity of the genus Cydonia.

The character of the ovules, six in each locule, arranged in two series of three, one superposed upon the other, seems to bring Pyronia nearer to Cydonia than to Pyrus.

LEAVES AND FLOWERS OF PYRONIA

The flowers resemble those of the quince parent slightly more than they do those of the pear parent. As the pear genus has been found to hybridize without great difficulty, Dr. Trabut suggests that many new combinations might be made in it, yielding new fruits of possible value. A hybrid between the apple and pear has already been secured, but its commercial value is not yet ascertained. Photograph actual size. (Fig. 13.)

This new genus created by hybridization may, without inconvenience, be maintained at least by horticulturists, if not by botanists who follow a fixed code of nomenclature. Botanists, it is true, have already made apples into pears, but practical horticulturists do not appreciate the scientific necessity of such a change.

In the aggregate of its characters *Cydonia Veitchii* is intermediate between Cydonia and Pyrus. It constitutes a bigeneric hybrid. Botanically this hybrid appears to be sterile, but horticul-

turally it is decidedly fruitful, yielding an abundance of well-formed, seedless fruits.

This first attempt to hybridize the quince and the pear should encourage plant breeders to make new attempts to combine the quince with those primitive species of Pyrus which have given us splendid and highly esteemed varieties of pears in such great numbers.

To Prevent Waste of Potential Ability

With a view to finding and conserving especially valuable variations in the human race, the Civic Club of Allegheny County (Pennsylvania), has established a Committee on Exceptionally Able Youths. Blanks are being sent to the school principals of Pittsburgh, with the following letter:

"The Committee on Exceptionally Able Youths of the Civic Club of Allegheny County is conducting psychological tests to find the most exceptionally gifted youths in Pittsburgh and vicinity who have dropped out of school prematurely or will do so before they have had the training appropriate to their abilities. Our work is limited to the very few individuals who have impressed the teacher or principal as having extraordinary ability, when this ability, without assistance, is not likely to receive proper development. Sometimes the families could afford further schooling and would provide it if they had tangible evidence from us of the very high qualities of the son or daughter. In other cases, a scholarship is necessary, and our recommendation will suffice to secure a number of these.

"Will you, therefore, select one or two individuals as described, who are in the eighth grade or high school or who have left school in the past few years, and send us their names and data as called for in the accompanying blank. We will then make an appointment when these individuals and others will be tested by a series of mental measurements."

The chairman of the committee, Professor Roswell H. Johnson of the University of Pittsburgh, is a eugenicist; the other members, Professors W. V. Bingham, J. B. Miner, G. C. Basset and F. A. C. Perrin, are psychologists.

A Study of Rural Epilepsy

NINE FAMILY HISTORIES OF EPILEPTICS IN ONE RURAL COUNTY. State of New York, State Board of Charities, Bureau of Analysis and Investigation. Eugenics and Social Welfare Bulletin, No. 7. Albany, N. Y., 1916.

The Department of State and Alien Poor in New York is taking an unusually intelligent view of its work, in the publication of the series of pamphlets above noted. One of its functions being established by law as the investigation of "the condition of the poor seeking aid," it is going to the bottom of the problem. The present bulletin is devoted mainly to a general review of the nature of epilepsy, in which it appears that heredity is held directly responsible for something like one-half of the cases. It has been estimated that there are in the United States perhaps as many as 175,000 epileptics—a population equal to that of the State of Wyoming. New York has a large colony for them (the Craig Colony) in Livingston County, and the families of nine inmates from a neighboring county were traced by Miss Florence Givens Smith, the results being presented in this bulletin. She has contented herself with publishing the facts, wisely refraining from any attempt to deduce laws of heredity.

CARMAN'S WHEAT-RYE HYBRIDS

Many Supposed Hybrids in the Rural New Yorker Series Show no Trace of Rye Characters—Only One Variety Originated from Real Wheat-Rye Hybrid—Descendant of This is Probably Still Grown

C. E. LEIGHTY

Bureau of Plant Industry, Washington, D. C.

ELBERT S. CARMAN,[1] editor of the *Rural New Yorker* from 1876 to 1899, achieved, in addition to editorial success, some remarkable successes as a plant breeder. His work in breeding potatoes is probably the most noteworthy, although his work with wheat and his accomplishment of crossing wheat and rye are of no mean proportions. About the time that he took up his editorial work (1876 or 1877) he turned his attention to attempts to improve wheats, first by selection, second by changing spring into winter wheats, third by crossing, and last by hybridizing wheat and rye.

In the *Rural New Yorker* of August 30, 1884, is shown what is probably the first illustration (Fig. 14) ever published of a hybrid between wheat and rye. The cross, however, had been effected by A. S. Wilson, of Edinburgh, Scotland, who presented his results April 8, 1875, in a communication to the Botanical Society of Edinburgh, without giving any illustration. The plants secured by Wilson were sterile and the hybrid therefore was not carried further than the first generation, the matter then being allowed to drop. Carman apparently knew nothing of Wilson's experiment at the time his work was done. The hybrid secured by Carman furthermore produced a few seeds, with which experimentation was continued and from the progeny of which a variety was produced and disseminated.

This cross between wheat and rye was made in the season of 1883.[2] A head of Armstrong wheat, a popular variety later known as Landreth, and today as Martin Amber, was selected for the mother, because it is a beardless, hardy, prolific variety, as much so as any of the 250 kinds tested on the Rural grounds, unless it may be the Diehl-Mediterranean, a bearded variety of hybrid origin. The anthers were extracted by the aid of a pointed stick as soon as the head was out of the boot, while they were perfectly green, and the head was covered, bound with worsted[3] for several days, when pollen of rye was applied to the stigmas from the point of a knife. This was repeated the next day, and the next, the head being again covered after each operation. Thus, before, while, and after he supposed the stigmas were receptive, pollen from rye was applied.

In this head ten more or less imperfect kernels formed which were planted late in September about a foot apart. Nine of these germinated, passed through the winter, and matured grain the next year, some being early, some medium, some late. There was no perceptible difference in the appearance of the plants during their early growth, except that some tillered more than others, but there were noticeable differences in the matured heads produced by the several plants.

From the illustrations and accom-

[1] For a short account of the life of Mr. Carman and some facts concerning his several achievements in breeding, see an article by Dr. E. M. East, in THE JOURNAL OF HEREDITY, Vol. VI, No. 2, pp. 65–67, February, 1915.

[2] The date, 1882, given in one account is evidently an error.

[3] This is according to an account given in the same year, 1883, although in 1886, in reviewing the work, it is stated, "the head was then bound with tissue paper," which was temporarily removed for pollinations.

WHEAT-RYE

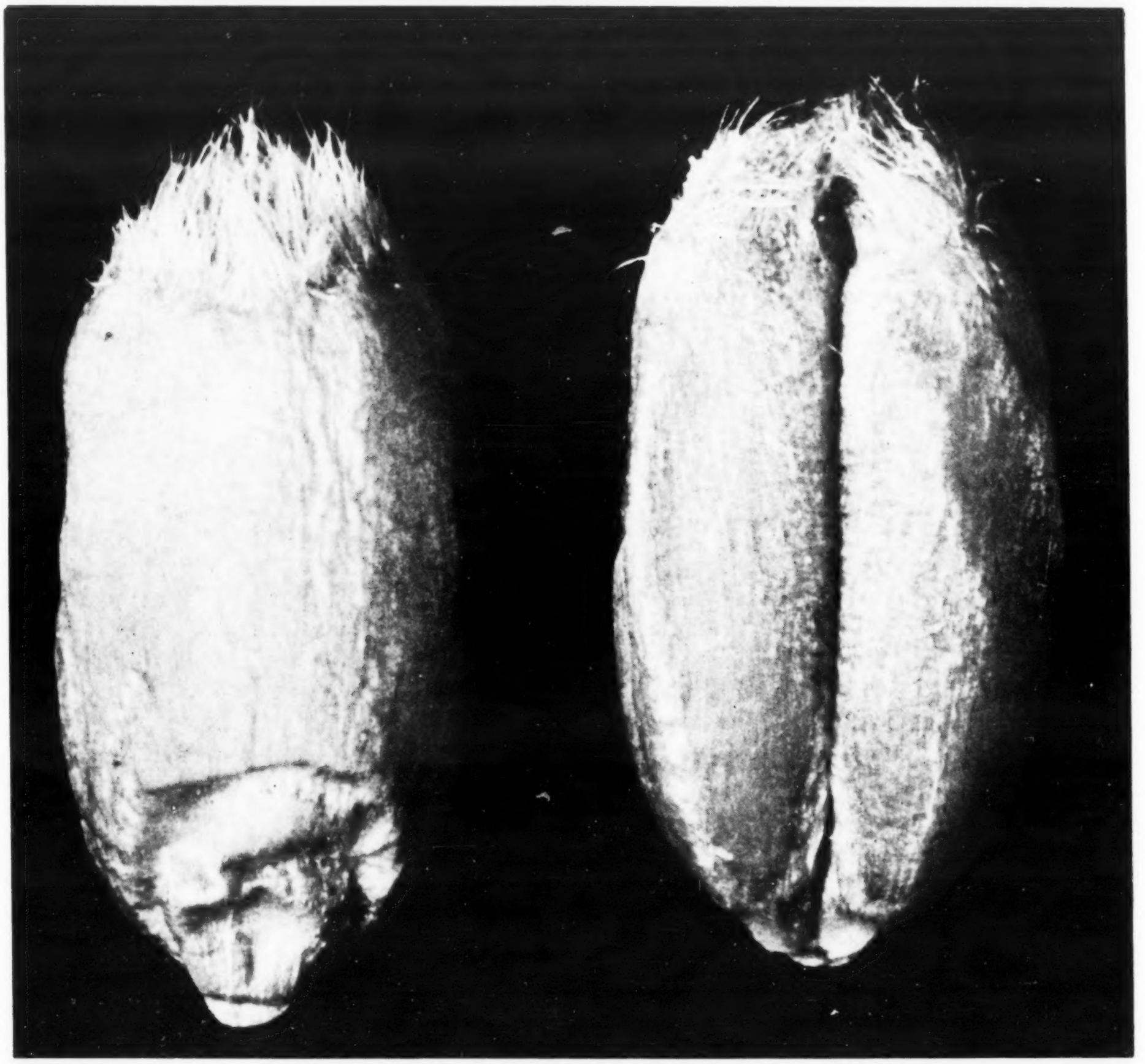
This is the first illustration ever published of a wheat-rye hybrid, and represents Carman's own work. It appeared as Fig. 339 in the *Rural New Yorker* on August 30, 1884. (Fig. 14.)

panying descriptions it is seen that the heads of eight of the plants produced, excepting that plant represented by Fig. 339 which will be considered later, differed from each other (1) in awn length, some having very short awns like the mother plant, others considerably longer awns, although none could be considered as fully bearded; (2) in color of chaff, some having white, others brown chaff; (3) in size and color of kernels produced—this, however, may be due to difference in maturity; (4) in straw color, some having lead-colored, others golden-colored straw. These eight plants were in later accounts referred to as "those from the fertile plants of the original cross" and "the eight original plants resembling wheat (or the female parent) more than rye," while the remaining plant, Fig. 339 (reproduced herewith, Fig. 14) is referred to as "the nearly sterile plant" or the plant which "most resembled rye."

The best of the heads produced by these plants were selected for further growing. "The plot of about one-twentieth of an acre" where these were grown "presented the next season when the heads appeared, as varied an appearance as if kernels of all the most dissimilar wheats in cultivation had been sown." Among forms appearing were club-shaped and tapering heads, bearded and beardless heads, while the straw was yellow, dark brown or purplish. The size of heads, number of kernels produced, and size of kernels all were variable.

NO TRACE OF THE RYE

After careful examination of the available records and illustrations there appears to the writer no evidence that in these eight plants or in their progeny there existed any trace of rye. It is further apparent to one familiar with wheat-rye hybrids and with hybrids between different varieties of wheat that these eight kernels, supposed to have developed as the result of the fertilization of emasculated wheat flowers with rye pollen, must have actually resulted from fertilizations of wheat flowers with wheat pollen. How this fertilization occurred in a head supposedly emasculated before its pollen was ripe is not known, but there are several possibilities, among which is this: If, as seems probable, *worsted* was used to wrap the head after emasculation, wheat pollen may have sifted through this from other flowers nearby. It is well



A GRAIN OF ARMSTRONG WHEAT

This is the variety with which Carman made his wheat-rye hybrids; it now goes under the name of Martin Amber. Photograph much enlarged. (Fig. 15.)

known that the glumes of emasculated wheat flowers when not fertilized will remain open for some time and if not protected by pollen-proof covering will often be fertilized by pollen, probably air-borne. Again, some fault not apparent may have existed in the technique. Be that as it may, these eight plants show no signs of being wheat-rye hybrids, although at least some of them must have been hybrids between different varieties of wheat.

CARMAN'S ERRONEOUS BELIEF

Although these "eight original plants resembling wheat more than rye" cannot be admitted to be actual wheat-rye hybrids, they were so considered by Mr. Carman. In all his later reference to them they are always considered to be hybrids of wheat and rye. Of all the wheats originated by him, the varieties first to be introduced, in 1889, included two descended through continued selections from these "fertile plants," these being Nos. 2 and 3. Both of these varieties were believed to be half rye, half wheat by parentage, though they had no appearance of rye in any respect. Introduced at the same time as these two wheats were four others, known as Nos. 50, 51, 53,

A GRAIN OF RYE

It will be readily seen that there are numerous small differences between this seed and that of wheat, and that the influence of rye would be clearly discernible, if present, in a hybrid. After carefully examining the descriptions of Carman's various supposed wheat-rye hybrids, Mr. Leighty reaches the conclusion that only one of his original nine was a real hybrid, the rest being nothing but wheat. Photograph much enlarged. (Fig. 16.)

and 55, originated by crossing different varieties of wheat. These were offered in August, 1889, by J. M. Thorburn & Co., of New York City, at 25 cents for a package containing twenty-five grains, or the collection of six sorts for $1.

In 1890 these six varieties were distributed free to applicants by the *Rural New Yorker*, and the varieties of special interest here were named as follows:

"No. 2 (hybrid wheat-rye) has been named

Willits after the Assistant Secretary of Agriculture.

"No. 3 (also a wheat-rye hybrid) has been named Roberts after Prof. I. P. Roberts, of Cornell University."

Although the names applied augured well for these wheats, they apparently proved of little commercial value and so far as the writer knows, are not in existence as varieties grown anywhere today.

Turning now to the "nearly sterile plant," or the one that "most resembled rye" (Fig. 14),[4] of the nine described above, it is evident from the illustration and descriptions that it was neither wheat nor rye, but had the modified characters of each. The shape and general appearance of the head, the arrangement and number of spikelets, and the glume characters were all such as are commonly found in wheat-rye hybrids. The culm resembled that of rye, except in color, having the whitish down near the head which never appears in wheat. This plant bore ten heads[5] which produced but nineteen kernels, thus being nearly sterile. All of these characters combined allow no question of this plant being actually a hybrid between wheat and rye.

MUCH VARIATION IN PROGENY

The grains produced by this plant were carefully sown and fourteen or fifteen plants resulted, which passed safely through the winter and produced altogether 107 heads, the single plants having from two to thirteen heads. As shown by an illustration which Carman published, they are all rather long, tapering, slender, and half-bearded, with more spikelets than in wheat, in their appearance giving abundant evidence of rye relationship. The characteristic hairiness on the culm beneath the head is depicted in each case, although such hairs might theoretically be lacking in some of the plants in this second generation. Some of the plants were feeble in growth and partly sterile. Others were remarkably vigorous in growth, with strong stems and many heads. Some ripened with the earliest wheats, others continued green until after the latest wheats had matured. The seeds varied in size, some being even larger than wheat, but as a whole they appeared to be wheat and yet had somewhat the shape of rye.

Rejecting all inferior heads, enough grain was saved from the best to plant a plat of about 1/30 (or 1/20) acre, that is, single kernels in the intersections of 10-inch squares. Regarding the crop grown Carman writes: "It is a matter of very great surprise to us that in this plat there is such a variety of heads that if evidence were suddenly placed before us that all of the varieties of wheat in cultivation sprang from accidental crosses between rye and wheat, we should accept it as in harmony with the appearance of these plants. The down does not appear upon the culms of some, while others are covered more thickly than the parent stems. The straws of some of the plants are three times the thickness of ordinary wheat straws. Some of the heads are beardless, others as much bearded as barley. Some heads are of the shape of Clawson, or the female parent Armstrong (tapering); others are club-headed, with and without beards. Some of the heads are compound. Our readers must remember that this twentieth of an acre of plants, so strongly dissimilar, all originated from a single seed, one of the ten kernels which four years ago was the result of crossing rye upon wheat."

The *New York World* in 1886 contained this description of the plants in this plat:

"Some of the plants were dwarf, not over 2½ feet high, with culms thrice as heavy as any ever seen in the pure wheats. Heads 7 inches long were not uncommon. Some were bearded heavily, others were beardless, and still others showed every intermediate stage. Some were club-headed, with breasts or spikelets densely crowded towards the top. Some bore compound spikelets, that is, two breasts growing instead of one, and the head partially double-breasted on each side of the rachis. Some heads were shapely, others twisted, with long, curly awns and culms as crooked as the heads. Some heads were larger and contained more kernels than any wheats we have ever seen growing in this climate. Others were feeble, narrow heads, scarcely 2

[4] "The portrait is true, except that the beards are nearly twice as long as shown." (*43*: 557.)

[5] "A later account states "14 heads" and "17 grains."

A WHEAT-RYE HYBRID

This grain is one of four produced on a wheat head from flowers cross-pollinated by C. E. Leighty. Although it is a genuine hybrid, it shows no traces of the influence of the rye (male) parent. The hairs at the top have been slightly retouched to make them more visible. Photograph much enlarged. (Fig. 17.)

inches long. The straws were all colors, from yellow to dark purple. They were of all thicknesses, from the size of rye to that of a small slate pencil. Some were densely downy, others smooth. Some were wiry and strong, others weak.

These plants were maturing variously, some with rye, some with wheat, while many were still perfectly green, with a good promise of not ripening at all. These strange plants, all from one seed, vary so remarkably, are so entirely different from either wheat or rye, that nothing short of seeing them can give the reader a good idea of them or enable authorities on grasses to intelligently consider the matter."

Long and faithful effort was expended in the task of fixing selections from the wheat-rye hybrids. In 1892 this statement was made concerning the progress up to this time:

"The illustration (Fig. 226) is a photo-engraving of typical heads of what we have alluded to as those hybrids between rye and wheat which are distinctly neither wheat nor rye; in other words, they are new grains. For some years we despaired of ever fixing them. Seeds from bearded, long, narrow heads, as shown at No. 1, were just as likely as not to produce beardless, club heads as shown at No. 6, and all the intermediates as shown at Nos. 2, 3, 4, and 5, though the heads of the same plant varied only in size, the same as fixed varieties vary. Again, the downy stem was inconstant. Seeds from plants with stems as downy as the chaff of velvet-chaff wheat would produce culms without down, though we have never known a smooth stem to produce one with down. It will be remembered that the stems of the rye for an inch or so below the head are always fuzzy or downy, and that this peculiarity in the rye-wheat hybrids must come from the male parent, rye. The quantity of down, however, is variable. Some of the stems of the hybrids are densely downy or plush-like, while others are just like the stiffer fuzziness of rye. Here again the stems of a plant are all alike. It never happens that one or several stems of a plant are fuzzy while the others are not.

"The heads shown in the illustration are those of varieties which seem to be fairly well fixed. The beard or beardlessness, the downy stems, and the general shape are quite constant. They vary chiefly in the size of heads, some plants from the same seeds yielding plants some of which bear heads twice as long as others. Selections are now being made to secure the largest heads. The grain itself is just as distinct as the heads. The kernels are long, of a dark amber color, while there is so little starch in them that they seem almost translucent like horn. It is reasonable to assume that such grain would make a highly nitrogenous flour. Of this, however, nothing is positively known.

"The down extending 2 inches or more below the heads is not apparent in our illustrations."

In 1892 there were introduced three new varieties originated by Mr. Carman,

these being Nos. 1, 4, and 52. Nos. 1 and 4 are described as follows:

No. 1.—By parentage half wheat, half rye. Mother parent Armstrong. Heads compact, symmetrical, pointed, bearded; brown chaff. Three grains to a spikelet, eight spikelets to a side. Kernels hard, reddish or dark amber. Straw very strong and of medium height. As early as rye. Thought to be very hardy.

No. 4.—By parentage half wheat, half rye. Mother plant crossed progeny of Armstrong. Heads symmetrical and absolutely beardless; brown chaff. Three grains to a spikelet, eight and nine spikelets to a side. Dark amber kernels. Stems very strong. Ripens with rye.

No. 52.—Originated as a pure wheat cross.

From the data given it cannot be ascertained whether these two varieties were actually descended from the true wheat-rye hybrid or whether they were descended from the supposed hybrids as were No. 2 (Willits) and No. 3 (Roberts).

No. 1 apparently survived longer than any other of the varieties introduced up to this time, as it was offered to the trade by the seedsman introducing it up to and including 1898, while in the meantime the others had been dropped from the lists. It is not known to the writer that any of these varieties are now grown, although a variety called "No. 4" was seen growing in New York State in 1912, the characters of which agreed with the meager description obtainable of the variety.

In 1894 two further introductions of wheat varieties were made, these being No. 57 and No. 6. Although No. 57 was not originated as a cross with rye, it is perhaps the best of all introductions made by Mr. Carman, and a description is appended.

"Peter Henderson & Co., of this city, now offer for the first time two of our wheats which the firm has kindly named Rural New Yorker No. 57 and Rural New Yorker No. 6. The first is a heavily bearded variety, the parentage of which is one of our crossbred varieties fertilized with a crossbred of Velvet Chaff. The down ("velvet") upon the glumes is very light, though perhaps heavy enough to resist the green fly, but not dense enough to invite mildew, which is often an objection to Velvet Chaff. We have raised our hybrids and crossbreeds only upon very small plats. From such trials, the No. 57 appeared to be a heavy yielder, with large, symmetrical, heavily-bearded heads, and tall wiry culms. It is a strong, vigorous grower, stools freely, and has never been winter-killed.

"The Rural New Yorker No. 6 is one of the rye-wheat hybrids, though all appearance of rye has disappeared except that the culms just under the heads are now and again downy as in rye. The downiness of the stem is variable. We have tried by selection for many years to fix it without any approach to success. Of all our rye-wheat hybrids, the downy culm is permanent in but one, and that resembles rye in several other respects. The Hendersons have found that No. 6 'succeeds and produces heavy crops on poor, thin land, where pure wheat could not be successfully or profitably grown.' This surely is a most valuable characteristic. Figure 165, page 630, shows the plant, one head, and several kernels."

THE ONLY REAL HYBRID

From this description and from a statement made elsewhere concerning its origin, it seems that No. 6 is actually descended from the true wheat-rye hybrid obtained in 1883. It is noteworthy for this fact, since it is the only variety introduced by Mr. Carman whose record, so far as determined by the writer, clearly indicated such origin. This variety is also still being grown, at least a variety bearing this name is now included among the wheat varieties of several experiment stations.

In common with the breeders of his day, Carman believed that the parents of a hybrid were equally represented in all self-fertilized individuals of subsequent generations. There might be variation in form but not in composition. He thought that by again fertilizing with rye pollen any plant of his first or later generations of wheat-rye hybrids, all intervening generations having been naturally self-fertilized, plants three-quarters rye by parentage would be secured. These plants or their

progeny in turn being again fertilized by rye pollen would produce plants seven-eights rye by parentage. By continuing this process plants fifteen-sixteenths rye, and so on in the same fractional series, could be secured, the further generations thus all the time approaching pure rye in composition. The laws of Mendel were not then known.

Actuated by the desire to produce rye in this way, and thus, if possible, to throw some light on the origin of wheat and rye, Carman, with true scientific spirit, made the crosses as required by the theory, carefully year after year. A head on one of the eight "fertile plants of the original cross" was emasculated and pollinated with rye pollen in 1884. One kernel resulted, which grew and produced twenty or twenty-two heads on which were three kernels. This was apparently an actual hybrid of wheat and rye, the female parent being wheat, as pointed out above. It was considered to be, however, three-quarters rye. These three kernels grew and two produced plants, but their subsequent history cannot be accurately followed from the accounts given.

TRIALS COME TO AN END

A head of one of the hybrids most resembling rye was emasculated and pollinated with rye pollen in 1885. On this, seventeen kernels were formed, which resulted in fourteen plants the next year, these being considered as three-quarters rye. By following this system with one (or possibly both—the account is ambiguous) of these lots of supposed three-quarter rye plants "several plants were produced with a supposed parentage seven-eights rye," and at least one with a supposed parentage of fifteen-sixteenths rye. The supposed fifteen-sixteenths rye plant was entirely sterile, and the supposed seven-eighths plants were nearly all sterile. In spite of these discouragements the experimenter continued until finally he writes: "This trial has come to an end through necessity or through causes over which we had no control, viz., absolute barrenness of the latest progeny." The belief is expressed that "any endeavors to originate a hybrid which shall be more than three-quarters rye will prove ineffectual." No variety of supposed three-quarters rye parentage was apparently ever actually introduced, although one known as No. 11 was placed for propagation and introduction, but no later account of it is found.

In 1897, several years after his different wheats had been distributed, some one asked "Are there any of the Rural hybrid wheats that you believe to be ahead of all other kinds in hardiness and prolificacy?" The candid spirit of the man is shown in the reply: "No, we have not received any reports which would justify us in placing any of the Rural hybrid wheats above the popular kinds of today. . . . Of the crossbred wheats which have originated at the Rural Grounds, the R. N. Y. No. 57 is very promising." And so the matter stands.

Correction

Through an editorial blunder, the paper on Pollinating Fruit Trees, in the last issue of the JOURNAL OF HEREDITY was credited to Leslie Gordon Corrie. The paper was written by, and should have been credited to, Reg. W. Peters, director of the Queensland Acclimatization Society, Lawnton, Queensland, Australia. Mr. Peters was formerly associated with William Bateson at the John Innes Horticultural Institution, Merton, Surrey, England, and took up the work in Australia last year. Members should note this correction in their copies of the August issue, in order that they may not repeat the error in making citations of Mr. Peters' paper at any time in the future.

COLLARETTE FLOWERS

T. D. A. COCKERELL, *Boulder, Colo.*

THE first collarette dahlia was exhibited in 1900, and placed on the market in 1901. This apparently unique variety, called President Viger, possessed the peculiarity of having supplementary lobes, of variable shape, at the base of the ray-corollas. These lobes or processes being white or nearly so, against the dark crimson background of the rays, were very effective, and the variety was at once recognized as an important addition to horticulture. During the last fifteen years the original collarette dahlia has been crossed with numerous other varieties, giving a long list of collarettes, of various colors.

It might readily be supposed that the collarette form was something absolutely new when it appeared in the dahlia less than twenty years ago. Experience with various compositae throws doubt on such an opinion, because we find that certain variations crop out here and there in diverse but more or less related genera, at different times and places. The variations of *Dahlia*, *Helianthus*, *Ratibida*, etc., run so closely parallel that whatever occurs in one we begin to expect in the others, while it appears increasingly probable that the whole group has been producing the known series of variations at intervals during past ages. The "origin" of a variety, as recorded, thus has to do only with the first occasion when it chanced to be detected on coming to the surface, as it were, of the stream of heredity.

The first collarette sunflower, of the chestnut and vinous forms of *Helianthus annuus*, was obtained in our cultures at Boulder, Colo., in 1915. Quite unexpectedly, a considerable number of plants showed this character, but the supplementary lobes were narrow and very variable, not nearly as showy as in the dahlia. The essential structure was, however, quite the same. This year we have a piece of ground devoted to collarettes, and by continued breeding and selection it is probable that the type will eventually be much improved.

The evidence seemed to indicate that the collarette sunflower had arisen for the first time in cultivation; but on September 24, 1915, I found a wild plant (*H. annuus lenticularis*) in Boulder, having genuine collarette characters. There was only one head on the plant, the last of the season, and in this two of the rays were tubular. There is apparently a connection between the variation with tubular rays and the collarette, as is especially indicated by *Arnica pedunculata* Rydberg[1] var. n. *tubularis*, found by my wife at Boulder, June, 1915. In this variety the ligules are tridendate at the end, as in the typical form, but are variably tubular below, with a liguliform process on each side of the mouth of the tube. From this condition to a collarette *Arnica* would be no great step.

The latest and in some ways most surprising collarette to be discovered is in the long-headed cone-flower, *Ratibida columnifera*.[2] This form (var. nov. *appendiculata*) was found by the writer at the base of Flagstaff Hill, Boulder, July 8, 1916. The rays possess long appendages, usually a pair, arising from the throat.

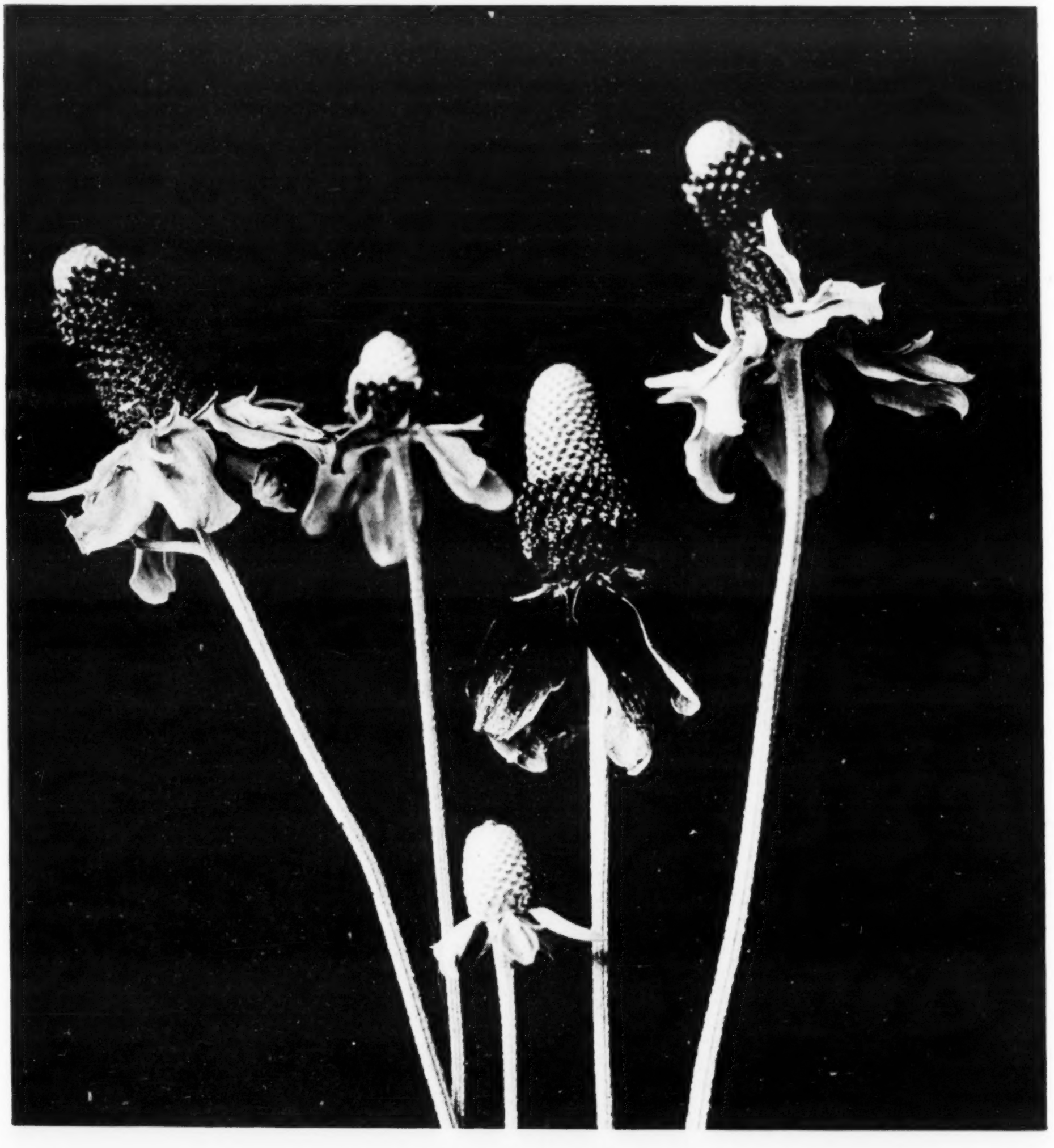
Although *Ratibida* is so different in many respects from *Helianthus*, having a long conical receptacle, the pappus a rudimentary crown, and the very peculiar disc-bracts with a long dark crimson spot on each side, the variations run parallel in the most astonishing way. The form with wholly or partly chestnut red rays, parallel with the red sun-

[1] *Arnica pedunculata* is common at Boulder. Apparently Nelson is correct in considering *A. monocephala* Rydb. to be a form of *pedunculata*, but wrong in referring them to *A. fulgens*.

[2] Wooton and Standley write *columnifera* in place of *columnaris*, the former name having a year's priority.

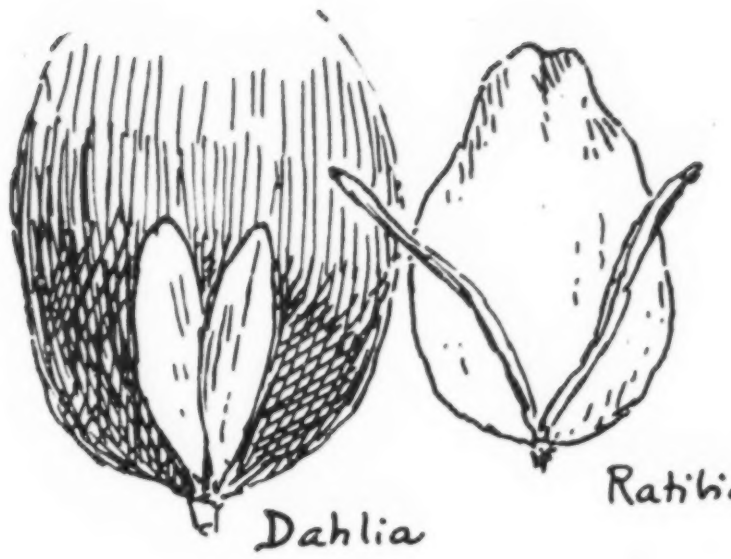
COLLARETTE SUNFLOWERS

From the original lot in cultivation at Boulder. The upper one is vinous, the lower chestnut red. The first record, with this illustration, was made in the *Gardeners' Chronicle* (London), November 6, 1915, p. 295. (Fig. 18.)



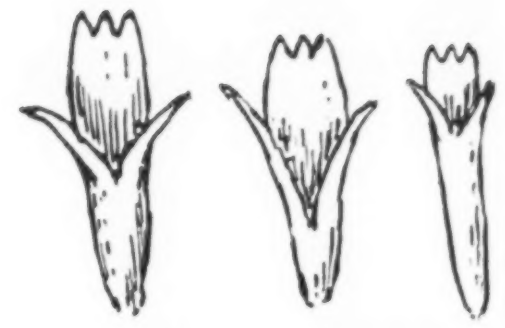
COLLARETTE CONEFLOWERS

The coneflower (*Ratibida columnifera*) is common on the Western prairies; but the specimens here shown are the first ones ever brought to light which are characterized by a collarette. The dark-rayed head in the middle is var. *pulcherrima*. (Fig. 19.)



Dahlia Ratibida.

2



Arnica pedunculata.

3.

ABNORMAL RAYS IN COLLARETTE FLOWERS

1. Ray of the first collarette dahlia (President Viger) showing the additional lobes described in the text.
2. Ray of the collarette coneflower with long, narrow, additional lobes.
3. *Arnica pedunculata* var. *tubularis:* variation in rays, showing appendages at throat of tube. (Fig. 20.)

flower, was described by DeCandolle under the name *pulcherrima* as early as 1836. This year Miss Hazel Andrews has found at Boulder a variety with pale yellow rays, like the "primrose" sunflower, and if this is crossed with *pulcherrima*, the F_2 will certainly include a vinous *Ratibida*. Varieties of *Ratibida columnifera* with twin or double heads, with short rays, with tubular rays, and with rays incised at the end, all exactly parallel variations of the *Helianthus annuus* group.

There is no reason for ascribing all these parallel variations to "reversion" to some common ancestor possessing such characters; we must rather suppose that the genetic composition of the whole group of genera is such that these particular changes arise from time to time, without reference to the environment. Whether, in any given case, they are due to original variations of the germinal substance, or are due to the cropping out of characters for which determiners have existed in the chromosomes for ages, may be extremely difficult to decide.

Annual Meeting of the A. G. A.

The next annual meeting of the American Genetic Association will be held in connection with the American Association for the Advancement of Science, in New York City in the week following Christmas. It is anticipated that that week will bring together one of the largest gatherings of men of science that has ever met in the United States. Members who desire to present papers at the meeting of the American Genetic Association should notify the secretary as far in advance as possible. Papers which are suitable will be published in the JOURNAL OF HEREDITY; others may be published by the authors elsewhere. Further details will be announced as soon as possible.

Breeding Citrous Fruits

All possible combinations of citrous fruits are being made at the Citrus Experiment Station, Riverside, Cal., according to Director H. J. Webber. Among the most important are: (1) Combinations of the mandarin and the tangerine with the good varieties of the common orange to obtain large fruited varieties with the easily removable skin of tangerine and the quality of common orange. (2) Cross of tangerine and blood oranges to secure blood tangerines. (3) Crosses of lemon with blood oranges to secure blood lemons. (4) Crosses of blood oranges with pomelo to secure blood pomelos and the like.

WHAT GENETICS IS

"An exact determination of the laws of heredity," says William Bateson, "will probably work more change in man's outlook on the world, and in his power over nature, than any other advance in natural knowledge that can be clearly foreseen."

To gain this knowledge is the object of the science of genetics, which proceeds, in practice, largely by means of plant breeding and animal breeding, for the reason that heredity is less complicated in these organisms than in Man, and its operation can be more easily made out. The knowledge so gained finds its application in methods for the improvement of cultivated plants and domesticated animals and, most important of all, in the improvement of the human race through the science of eugenics, which was defined by its founder, Francis Galton, as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally."

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